RADIO

HANDBOOK

ALFRED A. OFFNER

Other Helpful Books You Should Own

MODERN RADIO SERVICING
By *Alfred A. Ghirardi*

RADIO PHYSICS COURSE
By *Alfred A. Ghirardi*

SHORT WAVE RADIO HANDBOOK
By *Clifford E. Denton*

HOME-RADIO POCKET TROUBLE-SHOOTER "GADGET"
By *Alfred A. Ghirardi*

AUTO-RADIO POCKET TROUBLE-SHOOTER "GADGET"
By *Alfred A. Ghirardi*

YOUR INVENTION
(How To Protect and Merchandise It)
By *Elmore B. Lyford*

RADIO *Troubleshooter's* HANDBOOK

Companion Book to "Modern Radio Servicing"

ALFRED A. GHIRARDI

Author, The Radio Physics Course, Modern Radio Servicing, Radio Field Service Data. Contributing Editor, Radio News Magazine. Advisory Editor, Service Magazine. Editorial Consultant Radio & Electronics, Murray Hill Books, Inc. Technical Consultant. Member, Radio Servicemen of America, New York Electrical Society, Radio Club of America, Institute of Radio Engineers, Advertising Club of New York.

THIRD REVISED, ENLARGED EDITION

2I44

MHB

RADIO & TECHNICAL DIVISION . . MURRAY HILL BOOKS INCORPORATED

232 MADISON AVENUE **NEW YORK 16, N. Y.**

COPYRIGHT 1939, 1941, 1943
MURRAY HILL BOOKS, INC.

All tabulated and other data in this book is fully protected by copyright.

All rights reserved—no part of this book may be reproduced in any form, by mimeograph or any other means, (including translation into Foreign languages) without express permission in writing from the publisher.

No patent liability is assumed with respect to the use of the information contained herein.

COPYRIGHT IN CANADA AND GREAT BRITAIN
AND IN ALL COUNTRIES SUBSCRIBING TO
THE BERNE CONVENTION.

PRINTED IN THE UNITED STATES OF AMERICA

PREFACE

THIS *Third Edition* retains all the features that made the two previous editions so popular and successful, but all existing text, illustrations and data have been gone over and revised to bring them up to date. The book also has been considerably enlarged, with nine sections of vital new material added to keep its contents abreast of today's servicing practice and requirements, increasing still further its scope and value to radio technicians in their important wartime servicing role.

This Handbook is designed to supply practical factual servicing data that will help the radio service man in his daily work right at the servicing bench. It is intended to facilitate as much as possible his task of caring for home, portable and auto-radio receivers, automatic record changers and instantaneous recorders of all types —whether he is called in merely for the purpose of assuring their continued satisfactory operation, or to remedy some difficulty which has actually appeared.

The first edition of the Radio Troubleshooter's Handbook was compiled and released in 1939. It was the first radio service man's data book of its kind ever published. Like its successors, it was designed specifically to provide a practical working Handbook of helpful radio data. A second revised and enlarged edition was required two years later, in 1941. Perhaps the most convincing proof of the Handbook's real proved value lies in its widespread and universal, acceptance and popularity. In the brief period since its release, copies have been put to daily use in most of the radio service shops throughout the United States and in many foreign lands. If the hundreds of unsolicited letters of acclaim which have been received are any criterion, the Radio Troubleshooter's Handbook ranks as first choice today among important time-saving factual radio servicing data sources.

Such genuine appreciation, and the expressed needs of the army of new, unseasoned men and women who are entering the radio servicing field encouraged the author in these busy days to undertake this complete revision and enlargement. It is sincerely hoped that, in thus bringing the contents up to date and expanding the volume's scope, the service technician and radio dealer—irrespective of previous knowledge or experience—will find this Third Edition an even greater help in their work.

The effects of the government order to halt large-scale receiver production are making themselves felt. Onto the already burdened shoulders of the radio service man now falls the task of keeping in repair, with limited replacement supplies and facilities, the 55 million radio receivers in use in our country. It is imperative that he do a good job; uninterrupted communication facilities throughout the length and breadth of the land have never been so vital a necessity for the morale and the information of our people.

Thousands of radios are already at the stage when they should normally be replaced. For the duration, this will be largely impossible. The service man will be forced to repair many faulty parts which retain usefulness, to substitute and adapt the very limited variety and quantity of available replacement parts and tubes to cover the greatest possible variety of replacement requirements. This demand on his ability and ingenuity will require, as never before, complete fundamental knowledge of radio receiver circuits and design. Brains, adaptability, mechanical skill and plain "servicing horse sense" will now be among the most valuable of all his assets. Every time-saving bit of servicing information, every short-cut servicing method that he can bring to his daily work will pay rich dividends.

Under these new servicing conditions, the type of factual reference-material contained in this Handbook becomes increasingly valuable to the busy service man. Habitual use of it will save precious servicing time, more valuable now than ever before. The wisdom of including in it servicing data on the older receivers and tubes as well as the newer ones will now undoubtedly be proved.

All servicing "theory" has been purposely left out of this Handbook—the author's comprehensive text *Modern Radio Servicing* is written especially to supply that type of information. This Handbook is a practical source of on-the-job "working" reference data! Most of the material it contains is not to be found at any other source; some of it has heretofore been obtainable only from many different, inconvenient, and sometimes expensive sources.

A glance at the *Table of Contents* which follows, will quickly reveal the nature of the data and the practicability of the book. The quick-find arrangements employed for the material will be made clear within a few moments by thumbing through the entire book. Each type of data has been organized into the most logical, readily usable form possible, and presented in the particular sequence and arrangement that experience has shown will make it easiest and quickest for the service man to find, read, and use in his work. Whenever possible, the data has been arranged in alphabetical (or numerical) sequence as regards receiver makes and model numbers, automobile makes and model numbers, tube numbers, etc. Careful grouping of tables of data, charts and illustrations, the use of hundreds of cross-references

throughout, together with an unusually complete Index amply cross-referenced expedite the location of needed information and its quick extraction to solve servicing problems efficiently.

An important innovation included in this new Handbook for the first time consists of prefacing almost every data chart and table with specially prepared concise text which explains the nature and purpose of the data, together with instructions and actual typical examples for its correct use. This entirely eliminates "dead" material such as is found in so many other data books—"dead" because the service man does not fully understand the data as it is arranged, or does not know how to apply it in his work. This feature will enable service men to use the wealth of information contained in this book more frequently and to greater helpful advantage in their work.

The trouble *"Case History"* section which comprises a large part of the front portion of the Handbook is an important time-saving adjunct to the service man's test equipment and experience, for it represents in condensed, tabulated form the accumulated servicing information gained by thousands of hours of actual experience in service work on many different receivers and automatic record changers of each "model" and "make" listed (now over 4,820 models in all)—and under all sorts of installation and operating conditions. It is well known that many radio receivers and record changers become afflicted with particular troubles peculiar to that specific line or model. This "Case History" section tells what these troubles are, how to recognize them by the "trouble symptoms" they exhibit, and how to correct them quickly and directly. Service men report that the regular use of this information saves a tremendous amount of troubleshooting and repair time for them, enabling them to service many more receivers per day. The compilation presented here is by far the most comprehensive and largest ever published anywhere.

The *Intermediate-Frequency Transformer* and *Amplifier* data in Section 2, *"Aligning"* data in Section 3, and *I-F Alignment Peaks* chart in Section 4 supply information which is essential in all receiver "alignment" work. The data in these sections is up-to-the-minute, and has been carefully factory-checked to insure accuracy. This is mentioned here because the author has found that many of the "i-f peak" compilations which have been published in various books and servicing magazines in the past have been so incomplete and so literally "riddled" with errors that their usefulness is questionable. It is felt that because of the thoroughness and the care exercised in its preparation the listing presented in this book is the most reliable and complete source of "i-f" peaks now available to radio service men since it now presents the data for over 20,810 models of superheterodyne receivers.

Of special value is the revised and most complete Tube Characteristics and Basing Diagram Chart section ever published—28 pages long—giving for the first time anywhere, complete information on the characteristics, classification, interchangeability and socket connections of practically every type of American Receiving tube ever made, of Special-Purpose tubes, Transmitting tubes, Cathode-Ray tubes and Army & Navy tubes. No need to tell service men how helpful such a comprehensive tube data compilation is when servicing and replacing tubes in both current and old equipment.

There is little need to review each individual section here. The reader may do that for himself by carefully examining the contents of each page of the book and familiarizing himself with the material. After all, the acid test of its worth is how consistently helpful it proves in supplying quickly all the time-saving data that is needed every day in actual radio service work.

A vast number of sources have been consulted in compiling this volume. Credit has been given in the text for all material which has so generously and enthusiastically been made available to the author for this work, but a special debt of gratitude is hereby acknowledged for the generous, spontaneous and willing cooperation accorded by the representatives of the various manufacturing companies consulted.

The author and publishers are also indebted to the hundreds of service men who have cooperated so enthusiastically and unselfishly with the author by making their service records available to him and offering unbiased criticism and constructive suggestions which have been of great value in the compilation of this revised and enlarged edition. Mainly because of their assistance, we feel that in its present form, this Handbook will meet with the hearty approval of all those whom it is intended to serve.

It is my sincere hope that the data presented in this book will help to speed up and ease the daily work of that vast army of conscientious, hard-working but ever-harassed radio service men who are constantly striving to reduce the time required to troubleshoot and repair the receivers which come into their shops so that they may make a reasonable profit on every service job. If it is at all helpful in solving quickly for them what might otherwise prove to be troublesome problems, and if it succeeds in making their highly specialized tasks less burdensome, and less time-consuming, I shall feel amply repaid for the many hours spent in compiling this work. I shall be truly grateful if users of this book will forward to me (in care of the publishers) all suggestions that they may have for improving it or increasing the scope of its usefulness.

ALFRED A. GHIRARDI
NEW YORK CITY

May 1943

CONTENTS

Section		Page
	PREFACE	v
1.	"CASE HISTORIES" OF COMMON TROUBLE SYMPTOMS AND REMEDIES FOR 4,820 MODELS OF 202 MAKES OF "HOME"- & "AUTO-RADIO" RECEIVERS AND RECORD CHANGERS	1
2.	I-F TRANSFORMER CONSTRUCTION, TROUBLES, SERVICING & REPLACEMENT	405
3.	HOW TO "ALIGN" THE TUNED CIRCUITS OF SUPERHETERODYNE RECEIVERS	411
4.	I-F ALIGNMENT "PEAKS" OF 20,816 SUPERHETERODYNE RECEIVERS	415
5.	CROSS-INDEX OF MODEL NUMBERS OF *AMERICAN* RCA AND RCA-VICTOR RECEIVERS WITH THOSE OF CORRESPONDING *AMERICAN* GENERAL ELECTRIC, WESTINGHOUSE & GRAYBAR RECEIVERS	478
6.	CROSS-INDEX OF MODEL NUMBERS OF *AMERICAN* RCA AND RCA-VICTOR RECEIVERS WITH THOSE OF CORRESPONDING *CANADIAN* RCA, GENERAL ELECTRIC AND WESTINGHOUSE RECEIVERS	480
7.	TROUBLE-SHOOTING "REMINDER" CHART FOR "HOME-RADIO" RECEIVER TROUBLES	481
8.	TROUBLE-SHOOTING "REMINDER" CHART FOR "AUTO-RADIO" RECEIVER TROUBLES	488
9.	GEAR RATIOS AND SCALE CALIBRATION DIRECTIONS REQUIRED IN REMOTE TUNING CONTROLS FOR ALL AUTO-RADIOS	499
10.	ROUTINE AUTO-RADIO INSTALLATION & INTERFERENCE ELIMINATION DATA CHART FOR ALL AMERICAN PASSENGER CARS (antenna equipment; car battery "grounded" terminal polarities; breaker point and spark-plug gaps; generator "charging" rates; suppressor and by-pass condenser installation, bonding and shielding instructions for all American cars)	505
11.	HOW TO ELIMINATE "PERSISTENT" IGNITION-SYSTEM INTERFERENCE WITH AUTO RADIO RECEPTION IN VARIOUS MAKES & MODELS OF CARS	514
12.	ELECTRICAL WIRING DIAGRAMS OF 88 AUTOMOBILES	529
13.	RECOMMENDED REPLACEMENT CAPACITY VALUES FOR VIBRATOR BUFFER-CONDENSERS	542
14.	RECOMMENDED "REPLACEMENT" AND "ELECTRICALLY-COMPARABLE" BATTERIES FOR 1250 MODELS OF PORTABLE RADIO RECEIVERS	549
15.	PHYSICAL DIMENSIONS AND ELECTRICAL SPECIFICATIONS OF 12 LEADING MAKES OF "A", "B" AND "A-B" BATTERIES AND PACKS FOR PORTABLE AND FARM RECEIVERS	557
16.	GRID-BIAS RESISTOR RESISTANCE VALUES AND WATTAGE RATINGS FOR ALL SELF-BIASED TUBES	563
17.	"PLUG-IN" & "BALLAST" RESISTOR DATA, AND RMA DESIGNATION CODE	577
18.	RECEIVING TUBE CLASSIFICATION CHART—BY "INTERNAL STRUCTURE", BY "USE" OF TUBE AND BY "CATHODE VOLTAGE"	583
19.	NON-RMA "TYPE NUMBER" DESIGNATIONS FOR OLDER STANDARD NON-OCTAL BASED TUBES	587
20.	RMA "TYPE NUMBER" DESIGNATION SYSTEM FOR ALL OTHER STANDARD RECEIVING TUBE TYPES	588
21.	THE VARIOUS TYPES OF TUBE BASES AND SOCKETS ("STANDARD", "OCTAL", "LOKTAL", "LOCK-IN", "MINIATURE", ETC.)—AND THE "BASE-PIN" NUMBERING SYSTEMS FOR THEM	590
22.	RECEIVING TUBES—OPERATING CHARACTERISTICS AND BASING DIAGRAMS	594
23.	RECEIVING TUBE TYPES RECOMMENDED FOR SUBSTITUTION	612
24.	SPECIAL-PURPOSE TUBES—OPERATING CHARACTERISTICS & BASING DIAGRAMS	616
25.	TRANSMITTING TUBES—OPERATING CHARACTERISTICS & BASING DIAGRAMS	618
26.	CATHODE RAY TUBES—OPERATING CHARACTERISTICS & BASING DIAGRAMS	619
27.	U. S. NAVY STANDARD TUBE TYPES AND THEIR NEAREST COMMERCIAL (RMA) EQUIVALENTS	622
28.	U. S. ARMY STANDARD TUBE TYPES AND THEIR NEAREST COMMERCIAL (RMA) EQUIVALENTS	623
29.	U. S. ARMY—NAVY PREFERRED LIST OF TUBE TYPES TO BE USED IN NEW EQUIPMENT	623

CONTENTS—*(Cont'd)*

SECTION		PAGE
30.	MODERNIZING OLD RECEIVERS BY SUBSTITUTING NEWER TYPES OF TUBES	624
31.	TUBE TESTERS—IMPORTANT THINGS ABOUT THEIR SELECTION AND OPERATION	626
32.	INTERPRETATION OF RMA RECEIVING TUBE RATINGS	628
33.	PILOT & DIAL LAMPS—CHARACTERISTICS AND RMA BEAD COLOR CODE CHART	630
34.	RMA ST'D MOLDED RESISTOR, FLEXIBLE RESISTOR AND RESISTOR-CORD COLOR CODE, AND CODE CHARTS	633
35.	RMA ST'D. "PREFERRED" VALUES OF MOLDED RESISTORS	636
36.	RMA ST'D. MOLDED MICA CONDENSER COLOR CODE CHART	638
37.	RMA ST'D. "POWER", "I-F", "INTERSTAGE AUDIO" AND "OUTPUT AUDIO" TRANSFORMER LEAD COLOR CODES	640
38.	RMA ST'D. DYNAMIC SPEAKER LEAD COLOR CODE & PLUG CONNECTIONS	643
39.	RMA ST'D. BATTERY-CABLE LEAD AND PHONO-MOTOR COLOR CODES	644
40.	RMA PROPOSED SYMBOLS FOR RADIO SCHEMATIC DIAGRAMS	645
41.	CHART FOR DETERMINING WHEN TO REPLACE A PAPER OR ELECTROLYTIC CONDENSER WHOSE CAPACITY HAS DECREASED	646
42.	OHM'S LAW CHART FOR DETERMINING *E, I, R, W* IN D.C. CIRCUITS	647
43.	*R, I, E, W, & POWER RATING* CALCULATION CHART FOR MOLDED & WIRE-WOUND RESISTORS	648
44.	RELATIVE RESISTANCE & "TEMPERATURE COEFFICIENT OF RESISTANCE" OF 54 COMMON METALS AND COMMERCIAL RESISTANCE ALLOYS	650
45.	PARALLEL RESISTANCES—SERIES CAPACITANCES CALCULATION CHART	652
46.	REACTANCE CHART—REACTANCE OF INDUCTANCES AND CONDENSERS (at frequencies of from 1 cycle to 1,000 megacycles)	654
47.	REACTANCE AND RESISTANCE IN SERIES—OR PARALLEL—CALCULATION CHART	658
48.	"TIME CONSTANTS" OF RESISTANCE-CAPACITANCE AND RESISTANCE-INDUCTANCE SERIES CIRCUITS—(CHARTS)	662
49.	VOLUME & TONE CONTROL CIRCUITS—AND CORRECT RESISTANCE TAPERS	665
50.	"LITZ" WIRE SIZE, WEIGHT AND DATA CHART	668
51.	COMPARISON OF VARIOUS STANDARD WIRE & SHEET METAL GAUGES	670
52.	BARE & INSULATED COPPER WIRE DATA TABLE	672
53.	SINGLE-LAYER AIR-CORE COIL DESIGN CHARTS	674
54.	POWER TRANSFORMER DESIGN CHART	676
55.	POWER TRANSFORMER HIGH-VOLTAGE-WINDING REQUIREMENTS FOR OPERATING VARIOUS TYPES OF RECTIFIER TUBES	678
56.	FILTER DESIGN CHART (for low-pass "pi" type filters)	680
57.	OPERATING DATA AND CIRCUIT DESIGN CHART FOR RESISTANCE-COUPLED A-F AMPLIFIERS AND PHASE INVERTERS	681
58.	LOGARITHMS & LOGARITHMIC COMPUTATIONS	686
59.	DECIBEL—POWER RATIO—VOLTAGE RATIO—CURRENT RATIO CONVERSION TABLE	690
60.	WAVELENGTH-FREQUENCY—LXC CONVERSION TABLE	693
61.	TWIST DRILL SIZES, AND DRILLING DATA	696
62.	MACHINE SCREW, TAP, TAP-DRILL AND CLEARANCE DRILL SIZES	698
63.	DECIMAL & MILLIMETER EQUIVALENTS OF COMMON FRACTIONS	699
64.	CONVERSION FACTORS FOR ELECTRICAL, PHYSICAL AND MATHEMATICAL UNITS	700
65.	METRIC PREFIXES USED IN RADIO WORK—AND CONVERSION FACTORS FOR THEM	702
66.	HOW TO USE "EXPONENTS" IN RADIO CALCULATIONS	703
67.	SUMMARY OF IMPORTANT ELECTRICAL, RADIO AND VACUUM TUBE FORMULAE	704
68.	DIRECTORY OF RADIO, TELEVISION & FACSIMILE RECEIVER MANUFACTURERS, PRIVATE BRAND DISTRIBUTORS, AND RECEIVER "BRAND" NAMES	709, 710
69.	DIRECTORY OF MANUFACTURERS OF 35 KINDS OF RADIO ACCESSORIES	720
70.	DIRECTORY OF MANUFACTURERS OF 33 KINDS OF RADIO PARTS	728
71.	DIRECTORY OF MANUFACTURERS OF 28 KINDS OF SOUND AMPLIFIER EQUIPMENT	733
72.	DIRECTORY OF MANUFACTURERS OF 17 KINDS OF RADIO TEST INSTRUMENTS	736
73.	DIRECTORY OF "CORRESPONDENCE" AND "RESIDENT" RADIO SCHOOLS	738
74.	DIRECTORY OF RADIO MANUAL, HANDBOOK AND TEXTBOOK PUBLISHERS	738
75.	DIRECTORY OF RADIO MAGAZINES AND TRADE PUBLICATIONS	738
INDEX		739

"CASE HISTORIES" OF SYMPTOMS AND REMEDIES FOR THE COMMON TROUBLES THAT OCCUR IN 4,820 MODELS OF 202 DIFFERENT MAKES OF "HOME-RADIO" & "AUTO-RADIO" RECEIVERS AND AUTOMATIC RECORD CHANGERS

Value of Trouble "Symptoms" in Locating Troubles

IN many lines of service work, an experienced technician can quickly tell a great deal about the location and nature of commonly-occuring troubles by simply listening carefully to the operation of the device being serviced. For example, an automobile service man listening intently to an automobile engine in operation knows instantly from his experience that a certain regular "metallic" clicking noise usually means that one or more valve tappets requires adjustment; another peculiar characteristic "rattling" noise means that the fan belt is frayed or too loose and is striking something; a third low-pitched reverberating sound indicates that there is a leak somewhere in the muffler or exhaust manifold, etc. Knowing these "symptoms," he is able to get at the source of trouble immediately, and remedy it without making detailed, time-consuming tests.

So, too, every wide-awake radio service man who has had some experience in servicing radio receivers soon realizes that particular models of almost all makes of receivers develop certain definite troubles after being in use for some time; that is, almost the same troubles are usually found in the same model of receiver. These troubles are invariably accompanied by definite recognizable "trouble symptoms" in the operation — symptoms which can easily be recognized by simply attempting to operate the receiver.

Experienced service men soon find themselves taking advantage of this fact almost unconsciously, for when called upon to service a familiar model and make of receiver with a trouble symptom which they have run across before in a similar receiver, they immediately proceed directly to test the particular part which caused the trouble in the previously serviced receiver—without taking the time required to analyze or test the various stages and circuits of the entire receiver.

Value of Trouble "Case Histories" in Service Work

If a service man has access to a well-organized tabulation of the Trouble "Case Histories" for most of the popular models of the various makes of receivers and record changers, he will be equipped to make more speedy diagnoses and repairs on the equipment he is called upon to service, and can thus service many more receivers per day. A compilation of this kind for 4,820 models of receivers and automatic record changers has been made by the author from the actual service records of several large service organizations with which he is associated. It is authentic in every detail, and is presented as a valuable help and time-saver to practical radio service men in their daily work.

Factory-Recommended Parts and Wiring Changes Also Listed Here

Whenever the manufacturer of a receiver has found that certain changes made in the parts or wiring of a receiver improves its performance, the complete factory information for making such changes has been incorporated here in the Case History data for that receiver. If the service man finds, upon inspection, that the receiver is one of the "early" productions which has not yet had these changes made in it, it is good business for him to incorporate the changes in the chassis while it is in his shop, so that when the receiver leaves his hands its performance will be greatly improved. Usually, the changes required are only minor ones that take but a few minutes and require only a few relatively inexpensive parts to make. The service man can more than cash in on such improvements by increased customer good-will they result in, and the service charge he can make for this extra work.

Common Sense in Using "Case History" Compilations

Before presenting the compilation of Trouble "Case Histories" the author wishes to discuss several points that should always be kept in mind in connection with its use.

1) When using a compilation of receiver trouble "Case Histories," remember that the troubles listed are by no means the *only* ones which can occur in the equipment. They are the ones which have been found to occur *most frequently,* and are those which a service man should suspect and test for first.

(2) No service man, or student of radio servicing, should entertain the idea that all he needs to do in order

to become a successful service man is to "arm" himself with a voluminous list of receiver "Case Histories," throw all the rest of his analyzing and testing equipment and knowledge to the winds, and proceed to conduct his service work with little effort "by chart." Nothing could be further from the truth! As every experienced service man knows, many of the everyday troubles in radio receivers are *not* the "conventional" ones, and they are often located only by the most persistent and careful testing—yes, sometimes only by the merest chance or "luck."

(3) The list presented herewith will be useful as an *accessory* to the "conventional" routines of servicing "home" and "auto-radio" receivers, and should be consulted as a "first try." If the correct "trouble" and "remedy" are found with it, so much the better. The repair can then be made quickly without need for time-consuming analysis. If the "Case Histories" listed do not cover the particular case in hand, the service man should proceed immediately to troubleshoot the receiver in accordance with the latest technique of radio receiver analysis and testing (explained in detail in the book *Modern Radio Servicing,* by Ghirardi). In other words, the "Case History" compilation should be regarded as a *possible* time-saving accessory only—not as a new kind of service man's "brain."

How the "Case History" Compilation is Arranged

Service men who are growing tired of trying to use servicing data presented in such confusing and thoughtless form that it takes almost as much time to read through and digest the mass of text in order to find the particular data needed as it would to trouble-shoot the entire set by means of instruments will appreciate the "quick-find" arrangement employed for the material in this Case History section.

The receivers are grouped alphabetically by "Brand" Names, and doubly to assure easy reference, these are cross-listed with the *manufacturers'* names (in all cases where they differ). The various models of each manufacturer follow each other in progressive alphabetical and/or numerical order.

The various trouble symptoms (such as *"Intermittent Reception," "Crackling," "Sputtering Noises," "Fading,"* etc.) which may be noticed when the receiver is turned on (with the volume control set for "loud" operation) are listed clearly at the left, so they may be "spotted" easily and quickly. The corresponding "Causes" and "Remedies" for each are listed alongside, directly to the right. If the trouble occurs only at some particular setting of the volume control (or other control) this fact is stated. Where only the trouble "cause" is listed, the trouble is a minor one whose remedy is obvious, and it is assumed, of course, that the service man has sufficient radio knowledge to enable him to proceed directly to remedy it.

This system of arranging the data enables the service man to "spot" *quickly* in the Case History data compilation for each receiver, the particular *Trouble Symptom* which the receiver is exhibiting, without having to read through a mass of text—then having "spotted" it, *what is wrong* and *what must be done* to put the receiver in proper working order is explained for him *clearly, completely* and *concisely* without excessive verbiage, so that he may proceed at once with the work without loss of time.

Some Makes and Models of Receivers have more "Case History" Data Listed than Others

The fact that quite a large number of "Case Histories" are presented here for *many* receivers of certain makes, is not to be taken as an indication that these particular receivers (or the receivers of any manufacturer, for that matter) are particularly subject to trouble, or that any reflection on the quality of the receivers of those particular manufacturers is intended. Such is not the case! No receiver is perfect! All receivers are subject to troubles eventually. It is natural that a larger number of those receivers which have proved to be most popular, and have therefore had the widest sale, should be in use. Consequently, it will be found that a large proportion of the service calls are for receivers of these types, mainly because of this preponderance of the number of them in use. It is on these receivers, therefore, that the largest amount of trouble information gained from actual trouble-shooting experience has been obtained and recorded here.

No Case Histories on "Last Month's" Models

It will be noticed that "Case Histories" will seldom be found here for the very latest receiver models. The reason is obvious. One service job on a particular model of receiver does not properly make it a "Case History." Before really reliable and justified "Case History" material on a particular receiver model can be compiled, that model must have been on the market for a sufficient time for a large quantity of the receivers to have been sold and placed in daily operation, and for *the same troubles* to develop in a sufficient number of them to make it reasonably certain that the particular troubles are really common to that model of receiver and not just random troubles which are not likely to occur in many of them. Naturally, it usually takes some time for "Case History" troubles to appear in new models of receivers—therefore, do not expect to find "Case Histories" on receivers marketed during the past few months —unless the receivers were definitely released with some particular design or manufacturing defect which would

show up within a short time after being put into use. The "Case Histories" presented here are really "Case Histories"—not scattered records of random "one-time" service jobs. The latter have very little practical value as time-savers for the service man.

Both "Home-" and "Auto-Radio" Receivers Covered

The "Case Histories" presented here cover both "home" and "auto-radio" receivers. In addition to the information contained in these Auto-Radio "Case Histories," much valuable Auto-Radio servicing and installation data will be found in *Sections 8, 9, 10, 11, 12,* and *13* of this *Handbook*. The service man should read these sections and learn the information they contain. He should also refer to them constantly when doing Auto-Radio service and installation work.

Names and Addresses of Receiver Manufacturers

In order to assist service men who may find it necessary to communicate with the manufacturers of the receivers whose Case Histories are presented here—whether for additional servicing data, replacement parts, or any other reason—a complete compilation of the names and addresses of all radio receiver manufacturers, as well as the *trade names* of the receivers they manufacture, is presented in the Directory of Radio Receiver Manufacturers and Receiver Brand Names in *Section 59* of this *Handbook*.

(Case Histories start on next page)

"CASE HISTORIES" OF ACTUAL TROUBLE SYMPTOMS AND REMEDIES FOR THE COMMON TROUBLES IN 4,820 MODELS OF VARIOUS MAKES OF HOME AND AUTO-RADIO RECEIVERS AND AUTOMATIC RECORD CHANGERS

Trouble Symptom	*Cause or Remedy*

ACE

ACE A.C.-D.C. MIDGET

Crackling, "Sputtering" noises	1) a-c line wires from the rear of the chassis touching under the choke. Loosen the choke and run these wires around it instead of underneath it

ACRATONE

ACRATONE 2

Inoperative	1) inspect all parts mounted on shallow sub-base of chassis to determine whether any of them touch and "short" to one another. If so, separate or insulate them from each other

ACRATONE 9A

Squealing, Whistling	1) oscillation due to magnetic coupling between the second r-f coil and antenna coil. Turn second r-f coil to a position at right angles to antenna coil. Fasten in this position

ACRATONE 954

Condensers "shorting" frequently	1) replace all the fixed condensers that are subject to high voltage during operation, using good-grade condensers of high breakdown rating

ADMIRAL

ADMIRAL AEROSCOPE

Intermittent reception	1) grid condenser at 25L6G tube faulty. Replace

ADMIRAL 4A, 4D, 4F

Weak on low-freq. end of dial	1) tune receiver to weak signal around 600 kc.; then vary the i-f transf. peaking until best reception is obtained. Now re-tune the high-freq. oscillator and r-f trimmers carefully for best reception

ADMIRAL P5, XP5

Inoperative, Intermittent reception	1) clean battery/electric switch contacts with carbon tetrachloride and adjust them to make more perfect contact.
Buzzing sound when used on a-c	1) install a shield between the 117Z6GT and 1H5GT tubes. Ground shield to chassis

ADMIRAL 5X

Inoperative	1) "faulty" oscillator coil. Replace, or rewind

ADMIRAL 6M

Inoperative (no plate voltage. Tubes light up and test OK)	1) check for high potential "short" between plate-return lead and coil shield of 2nd i-f transformer—very likely at soldering lug

ADMIRAL BA-41

Inoperative	1) check for "shorted" 0.01-mfd. condenser in power pack can—connected between one vibrator socket terminal and ground (or chassis)

ADMIRAL 69M5 Record Changer

Speed erratic	1) check for warped turntable 2) check for "binding" spindle in bearing 3) check for poorly lubricated motor
More than one record drops off spindle during change cycle	1) see if center holes on records are too large, or worn

ADMIRAL AM-488, AM-787

Tuning dial drive belt slips off guide pulleys	1) remove flywheel from shaft. Make ¾ in. washers from thin copper or brass, with ¼ in. hole drilled in center. Solder a washer to each exposed side of guide pulleys

AIR CASTLE

AIR CASTLE

Inoperative over part of dial	1) failure of 6D8G tube to oscillate. Try substituting a 6A8 (or 6A8G) for it

AIR CASTLE "ALL-WAVE"

Intermittent reception	1) oscillator tube cuts on and off intermittently. If changing the tube, grid condenser and resistor do not eliminate the trouble, check the oscillator section of the tuning condensers for leakage. Replace this condenser if leaky

AIR-KING

AIR-KING 52

Inoperative, Intermittent reception	1) primary windings of oscillator coil and last i-f transformer "open." Replace coils and re-neutralize receiver

AIR-KING 909

Phonograph turntable slips	1) rubber washer between turntable and motor spindle oil-soaked from motor. Replace washer

AIRLINE
(Montgomery Ward & Co.)

AIRLINE Auto Radio

Interference (not due to car-ignition trouble)	1) examine and see if a rubber grommet is used over the station-selector drive cable to hold it securely in place. If it is, try removing this rubber bushing and build the space up with ¼-inch shielding to provide better grounding

AIRLINE Alexander

Squealing (receiver cannot be properly aligned)	1) check the value of the center-tap resistor of 2½-volt winding. It should be 150 ohms. Replace if necessary

AIRLINE "Challenger"

Inoperative, Radio smokes	1) shorted 1-mfd. condenser causing excessive current to flow through the 4,000-ohm carbon resistor. Install a new 1-mfd. condenser rated at 400-volts. Replace resistor with wire-wound type

AIRLINE TRF Receivers

Poor tone	1)	connect a 10,000-ohm resistor across the primary of the push-pull input transformer. Connect a 0.02-mfd. condenser from the plate terminal of the primary to one side of the secondary

AIRLINE 05 BA

Squealing	1)	replace the 0.002-mfd. detector plate condenser with one of 0.01-mfd. If oscillation still persists, connect another 0.01-mfd. cond. from choke to chassis

AIRLINE 07B (32-volt Farm Receiver)

Noisy (scratching noise)	1)	faulty push-pull input transformer primary winding. Replace transformer

AIRLINE BATTERY 5

Insensitive, Poor tone	1)	replace the type '34 detector tube (unshielded '34 tube at rear of chassis) with a '32 tube, and make the following circuit change: connect the grid return directly to C —9 volts (brown lead), eliminating the 1-megohm resistor from the circuit entirely

AIRLINE 9

Squealing	1)	remove the shaft of the gang condenser. Clean it where it contacts the frame, clean spring contacts and adjust screw

AIRLINE AE-11

Low volume, Broad tuning	1)	section of variable condenser out of alignment. Adjust plates until spacing appears uniform, then realign
Squealing at 1500 kc	1)	re-neutralize the receiver circuits
	2)	interaction between the bus-bar grid leads. Bend them close to chassis to reduce interaction effects
	3)	loose coil shields. Tighten them so that they make good contact
Slipping dial drive	1)	loosen the set-screw holding the tuning drum after wedging the friction drive open. Turn the drum a half turn and tighten the set screw, making sure that the drum engages properly with the friction drive

AIRLINE 33

Intermittent reception	1)	tuning condenser plates touch intermittently due to end-play in rotor. Caused by weak contact spring in rear of condenser

AIRLINE 40, 40A

Whistling, especially around 800 kc	1)	replace the oscillator grid leak with one of 40,000 ohms. Try several tubes in the oscillator circuit
Intermittent	1)	open 0.5-meg. resistor in plate circuit of '24 AVC tube. Replace with new unit

AIRLINE 62 SERIES*

Inoperative when new or in use only a short time	1)	defective two-section armored wirewound resistor. Replace with 25,000-ohm, 1-watt and 1500-ohm, 2-watt units respectively
Intermittent reception	1)	intermittently open-circuiting 3,200-ohm "Candohm" resistor furnishing cathode and suppressor grid bias to the type '57 first det.-oscill. Replace (1-watt unit)

*Note: The prefix "62" in all the model numbers which follow indicates Radio Division in Montgomery-Ward catalog.

AIRLINE 62-11, 62-12

Insensitive	1)	remove the filter choke and its 0.25-mfd. shunting condenser from the circuit. Remove the second filter condenser (a dry electrolytic type) with a 4-mfd. 450-volt unit. If a hum appears, use an 8-mfd. condenser in this position instead

AIRLINE 62-14

Reception only at high-frequency end of dial	1)	check tuning condenser plates for "shorts" at the "in" and "near-in" positions
	2)	check the value of the 40,000-ohm resistor between the control-grid of the '27 oscillator tube and ground. This often changes, necessitating a replacement

AIRLINE 62-22

Intermittent reception, Fading	1)	"open" cathode by-pass condenser i-f stage
Distortion, Overloading on local stations	1)	if AVC plate voltage is somewhat high when receiver is first turned on, look for an open-circuited resistor between the oscillator and r-f screens to plate of AVC tube. Also check for an "open" in the "localizer"—especially at the "cathode" side of the control. The divider resistance should be 4,300 ohms total, tapped at the 1,100-ohm point. Make tests from suspected point to cathode instead of to ground
	2)	check for "open" cathode by-pass condenser in i-f stage

AIRLINE 62-68

Intermittent reception	1)	3,200-ohm "Candohm" resistor (furnishing cathode and suppressor grid bias to the '57 first detector-oscillator) "opens" periodically. Replace with 1-watt unit

AIRLINE 62-70

Intermittent fading	1)	"open" or "leaky" 0.04 mfd. audio-coupling condenser between '56 second detector and grid of '47 output tube. Cond. located below '47 tube (under chassis)

AIRLINE 62-72

Intermittent fading	1)	same trouble and remedy as listed for Airline 62-70 receiver
"Dead" receiver (no voltage on screens)	1)	field coil "open", opening the screen voltage supply circuit. As this receiver has two speakers, it may be made to operate by bridging the "open" field (*red* and *yellow* wires) with a 10,000-ohm, 10-watt resistor

AIRLINE 62-76

Improving bass response, Avoid overloading of 47's	1)	change plate resistor in '57 first a-f stage from 50,000 to 25,000 ohms. Shunt a 0.006-mfd. condenser from the variable arm of the manual tone control to high-pot. end of this same potentiometer

AIRLINE 62-77

Inoperative or erratic on low-freq. end of dial	1)	moisture in oscillator coil. Bake out moisture and dip or paint coil dope on

AIRLINE 62-89

Weak, Insensitive	1)	faulty last i-f transformer. Replace with part *No. P5127* only, as other transformers are unsatisfactory

AIRLINE 62-97

Inoperative	1)	check the 0.1-mfd. plate by-pass condenser of the '58 tube for a "short." If necessary, replace with a 400-volt unit

AIRLINE 62-98

Hum	1)	connect the cathodes of the 25Z5 rectifier tube together, and by-pass with an 8-mfd. 200-volt electrolytic condenser.
To improve the volume control	1)	substitute a 5,000-ohms volume control for the present 10,000-ohm unit, and move the 0.001-mfd. input blocking condenser to the rear of the chassis—away from the antenna coil
To improve the tone	1)	replace the 0.006-mfd. condenser (from the plate of the 43 tube to ground) with a 0.05-mfd. unit

AIRLINE 62-99

See also Case History listed for Airline 62-97

Inoperative	1)	faulty '32 oscillator tube. Try several tubes. Readjust plate and screen voltages, if necessary
Weak, low volume	1)	check tone control condenser for leakage

AIRLINE 62-103, 62-105

Inoperative	1)	"open" 415-ohm flexible wire-wound resistor
	2)	"shorted" screen by-pass condenser on 6D6 r-f and detector stages
Weak, Low volume	1)	no screen voltage on the 6C6 and 6D6 tubes. Due to "open" in the tapped screen voltage-dropping resistor mounted on the rear panel of the sub-base. Replace with a 17,500-ohm 10-watt unit
	2)	it is also well to replace the 0.25-mfd. screen by-pass condenser

AIRLINE 62-106, 62-107

Inoperative, Weak reception	1)	if d-c voltage at tube socket terminals checks very low, or zero, check the 0.1-mfd. tubular by-pass condenser connected from the plate-supply lug of the 3rd i-f transformer (plate circuit of 2nd i-f '58 tube) to ground. Use a 600-volt unit for replacement

AIRLINE 62-120

Same Case History as that listed here for Airline 62-122.

AIRLINE 62-121

Same Case History as that listed here for Airline 62-106.

AIRLINE 62-122

Inoperative, Intermittent reception	1)	if '34 second detector tube burns out or is found to be faulty, before replacing it with a new tube test the (50-mmfd.) coupling condenser between this tube and the preceding one. It is made of braid tubing pulled over a piece of silk-covered wire, and usually becomes corroded inside and "shorts." Since the 70-mmfd. condenser across the primary of the first i-f transformer, the 45-mmfd. condenser across the secondary of the first i-f transformer, the 200-mmfd. condenser in the antenna circuit, and the 35-mmfd. grid condenser of the first detector-oscillator tube are also of this type, they should also be checked. All can be replaced with mica-dielectric moulded cond. of these same capacities

AIRLINE 62-123

Inoperative	1)	check two-section armored wire wound resistor for "open," or "ground." Replace with a 25,000-ohm 1-watt and a 16,000-ohm 2-watt unit, connected in series

AIRLINE 62-126, 62-128

Same Case History as that listed for Airline 62-122 receiver

AIRLINE 62-131, 62-133

Same Case History as that listed for Airline 62-123 receiver

AIRLINE 62-134

Inoperative, Weak reception	1)	check the 0.25-mfd. 200-volt tubular by-pass condenser connected in parallel with the 6-mfd. electrolytic condenser from screen-grid to ground. Replace with a condenser having a rating of not less than 400 volts
High-pitched whistle intermittently	1)	check the 100,000-ohm oscillator grid-leak resistor, and replace if found faulty

AIRLINE 62-135

Weak, or no reception, Motorboating when volume control is advanced more than half way	1)	if plate voltages are low all around and there is no bias and heavy plate current on the 2A5 and 2A6 tubes, check resistor *R-14* for an "open" circuit. Lack of screen voltage is due to an "open" in resistor *R-11*. Replace with a resistor of 12,500 ohms
Oscillation	1)	aligned too closely. Align with 'scope; try to obtain smooth curve free from ragged spots that indicate oscillation tendencies

AIRLINE 62-136

Weak reception	1)	slightly leaky 0.25-mfd. condenser between 6D6 screen and 12A5 cathode

AIRLINE 62-139

Inoperative, Weak reception	1)	same Case History as that listed for Airline 62-134 receiver

AIRLINE 62-142, 62-144

Same Case History as that listed for Airline 62-123 receiver

AIRLINE 62-149

Distortion	1)	often caused by oscillation in the i-f amplifier. Try shielding the control-grid leads of the 32 and 34 tubes. Also try adjusting the i-f trimmers for stability and sensitivity rather than to a specific i-f

AIRLINE 62-150, 62-154

Same Case History as that listed for Airline 62-135 receiver.

AIRLINE 62-160

Distortion (especially when B-battery is run down)	1)	locate the 2-megohm bias resistor connected between the control grid and the "positive" filament terminal of the 34 second detector tube. Replace it with a 750,000-ohm resistor

AIRLINE 62-177

See also Case Histories listed for Airline 62-196 receiver.

Inoperative	1)	check for a "shorted" 0.01-mfd. coupling condenser between the plate of the 6B7 tube and the grid of the 6F6
Loud volume with double-hump resonance curve	1)	replace the 300,000-ohm resistor between the screen-grid of the 6F6 and 6B7 tubes

AIRLINE 62-190

Intermittent reception	1)	replace 0.01-mfd. coupling condenser connected from 6B7 tube to 6F6 tube control grid

AIRLINE 62-196

Loss of volume, Distortion	1)	try replacing the 6F6 tube (next to the '80 rectifier tube)
Noisy (intermittently)	1)	check 0.25-mfd. condenser connected between *blue* and *red* resistors on plate of 6B7 tube. If leaky, replace both the condensers and the *red* resistor
Tuning-dial indicator action not satisfactory	1)	shorten the spring controlling the friction drive in order to secure a more positive dial-indicator action in these receivers

AIRLINE 62-203

Crackling noise when tuning stations	1)	loose shaft bearing on manual tuning control. Install a small coil spring over shaft, so that shaft is pushed tightly against one side of its bearing surface

AIRLINE 62-207

Crackling, Distortion	1)	check for "leakage" in 0.05-mfd. 180-volt condenser by-passing small choke on rear of chassis

AIRLINE 62-215

Inoperative	1)	replace 0.05-mfd. tubular by-pass condenser mounted on side wall of chassis

AIRLINE 62-226, 62-228

Inoperative, Weak reception	1)	"shorted," or "leaky" screen by-pass condensers *C-7* (0.05-mfd.) and *C-14* (0.1-mfd.). Replace with 600-volt units
Tuning eye inoperative, No avc action	1)	check 0.05-mfd. blocking condenser (*C-5*) in the 6K7 r-f tube grid return circuit
Insufficient deflection on Tuning Eye	1)	replace resistor *R22* (connected from grid of 6G5 tube to ground) with a 0.06-mfd. 600-volt condenser

AIRLINE 62-236 Auto Radio

Noisy	1)	faulty 0.0075-mfd. 1,600-volt condenser connected to plates of 84 tube
Distortion	1)	connect a 25,000-ohm resistor between ground and the first lug on the volume control as you look into the receiver from the bottom

AIRLINE 62-249

Tuning eye inoperative	1)	check 1-megohm resistor connected between tuning eye target terminal and plate circuit (mounted on tuning eye socket between target and plate pin holes). Replace with new 1-megohm 1-watt unit

AIRLINE 62-251

Noisy	1)	check all tubes for noisy operation
	2)	replace 0.01-mfd. condenser *C-20* (connected between the antenna post and the broadcast band pre-selector coil) with a 0.05-mfd. 600-volt tubular unit

AIRLINE 62-254

Intermittent operation "B" batteries discharge rapidly during periods of non-operation	1)	two "hot" leads (running from pin-jacks on the terminal strip of the speaker and around the speaker frame to the high-impedance dual coils of the speaker) "shorting" to the speaker frame Unsolder the leads and slip spaghetti tubing over them. Secure leads in place with some cement to prevent them from working loose and interfering with the speaker armature

AIRLINE 62-255

Same Case Histories as those listed for Airline 62-251 receiver

AIRLINE 62-259

Same Case History as that listed from Airline 62-226 receiver

AIRLINE 62-293

Intermittent reception	1)	replace the black-and-white striped wire connected between the *No. 8* terminal of the 6C5 tube nearest the front of the receiver and the band switch terminal.

AIRLINE 62-301

Hum	1)	check 6F5 tube for cathode-to-heater leakage
	2)	dress 6F5 grid lead from center contact on volume control away from heater connection and all a-c leads
Lack of bass at low volume levels	1)	improper bass-compensation network. Replace present volume control with 1-megohm unit tapped at 300,000 ohms from low side. Remove original 5,000 ohm resistor and 0.05-mfd. condenser used for bass-compensation, and replace with a 30,000-ohm resistor and 0.008-mfd. condenser respectively

AIRLINE 62-305

Intermittent reception	1)	"open" 0.1-mfd. condenser between terminals 4 and terminals 5, 7 and 8 of 15DG tube
Whistling (usually when volume control is turned up)	1)	"open" condenser (*No. 119-22* on circuit diagram) connected between one side of *Candohm* resistor and terminal *No. 5* of the 1D5G tube

AIRLINE 62-307

Inoperative	1)	oscillator dead. Replace mica condenser connected from grid of 6C5 oscillator to coil terminal
Noisy, Intermittent reception	1)	replace the 1-megohm volume control (part *No. 101-46*)

AIRLINE 62-308

Same Case History as that listed for Airline 62-226 receiver

AIRLINE 62-316

Inoperative on broadcast band, but O.K. on short waves	1)	connect a 0.003-mfd. condenser *across* the *C-6* condenser (one of the pair of units next to the front of the chassis)

AIRLINE 62-318

Same Case History as that listed for Airline 62-226 receiver

AIRLINE 62-325

Distortion at medium or low-volume levels	1)	replace ½-meg. 2nd-det. screen resistor with 0.7 meg. unit to improve reproduction

AIRLINE 62-327

Weak signals	1)	"leaky" 0.02-mfd. condenser by-passing the ¼-watt *brown* resistor located in center of r-f choke assembly. Replace

AIRLINE 62-403

Distortion	1)	check capacity of 5-mmfd. coupling condenser *C-33* in i-f circuit for more than 5% change in value. Replace

AIRLINE 62-408

Same Case History as that listed for Airline 62-226 receiver

AIRLINE 62-413

Crackling intermittently	1)	faulty contact in the 156.5-ohm section of the resistor which produces the bias for the AVC and audio tubes. The first-audio 6C5 cathode connection is usually at fault. Install 156.5-ohm resistor between 6C5 first-audio and 6C5 AVC cathodes to replace the faulty section

AIRLINE 62-418

Same Case History as that listed for Airline 62-226 receiver

AIRLINE 62-425

Whistling (accompanied by hum)	1)	check 8-mfd. electrolytic condenser for intermittent "opening." Replace with an 8-mfd. 450-volt condenser
No reception (hum only)	1)	"open" 8-mfd. section in the dual 8-mfd. electrolytic condenser in cylindrical container on top of chassis. Use a "common-positive" type replacement unit

AIRLINE 62-475

Whistling around 600 kc.	1)	either replace the 8-mfd. filter condenser, or connect a 0.25-mfd. condenser in parallel with it, keeping the connecting leads as short and direct as possible

AIRLINE 62-2126

Inoperative	1)	remove antenna coil and check for "open" secondary

AIRLINE 64

Weak signals, Tuning meter inoperative	1)	if volume increases when finger is placed on control-grid cap of first r-f '58 tube the meter is burned out. If operation is desired until the meter can conveniently be replaced, merely "short" it out

AIRLINE 77

Inoperative or erratic on low-freq. end of dial	1)	moisture in oscillator coil. Bake out moisture and dip or paint coil dope on coil
Poor tone after replacing faulty '19 tube	1)	decrease grid bias from 6- to 4½-volts by shifting the grid bias connection from the 6-volt pin to the 4½-volt pin
Static-like noise	1)	faulty primary winding of 175 kc push-pull input transformer. Replace

AIRLINE 93BR-420B, 93BR-421B, 93BR-423B, 93BR-424B, 93BR-431B

Excessive hum, Stuttering on speech, Low volume, (all d-c voltages low)	1)	"shorted" electrolytic condenser
Whistling, Distortion	1)	"open" by-pass condenser

AIRLINE 95

Same Case History as that listed for Airline 77 receiver

AIRLINE 123, 131, 133, 142, 144

Same Case Histories as those listed under Airline 62 Series

AIRLINE 182

Smell accompanies operation of receiver (due to overheating of power transformer)	1)	the filament leads to the various tubes, which are twisted together and bunched close to the chassis, "short" to it. Test for this condition by unsoldering the center-tap of the filament winding from "ground," and check the continuity. Any reading indicates a "short" between the filament leads and chassis

AIRLINE 190

Intermittent reception	1)	if signal cuts in and out gradually, check the audio coupling condenser for "leakage"
Fading, (followed by hum)	1)	replace cathode by-pass condenser

AIRLINE 198

Inoperative	1)	"open" 0.1-mfd. condenser connected between waveband switch and first lug on rack of three trimmers mounted on coil assembly

AIRLINE 203

Inoperative	1)	check 500-ohm 1-watt resistor and 0.25-mfd. 400-volt condenser located behind volume control. Replace

AIRLINE 209

Inoperative at times, O. K. at others	1)	clean band switch contacts with cleansing fluid

AIRLINE 211

Distortion	1)	check resistor in plate circuit of 34 detector tube. Replace with 40,000-ohm unit

AIRLINE 225

Intermittent distortion after several hours operation	1)	check for warping of voice coil form after speaker warms up, causing it to rub against the pole piece

AIRLINE 290

Fading	1)	try replacing the 6A8G tube even though it checks O. K. in a tube checker

AIRLINE 320

Distortion at low volume	1)	change the 0.5-megohm second detector screen *R-5* to a 0.7-megohm unit

AIRLINE 321

House fuse blows when a "ground" is connected to receiver	1)	check for "grounds" in automatic tuning unit

AIRLINE 326-W

Inoperative	1)	short-circuit between the two wires running from the high-voltage secondary of the power transformer to the plates of the type '80 rectifier tube due to poor insulation. Replace wires
Weak reception, Noise, Power transf. "smoking"	1)	2,460-ohm section of speaker field coil "open." Replace the field coil

AIRLINE 351

Same Case History as that listed for Airline 290 receiver

AIRLINE 403

Distortion	1)	check 15-mmfd. i-f coupling condensers for change in capacitance

AIRLINE 451

Same Case History as that listed for Airline 321 receiver

AIRLINE 455

Same Case History as that listed for Airline 290 receiver

AIRLINE 504

Inoperative at low-freq. end of dial	1)	unstable operation of oscillator. Change oscillator grid leak from 20,000 ohms to about 50,000 ohms

AIRLINE 729A

Inoperative (all tubes and voltages check O. K.)	1)	move the *brown* lead from the *green* lead terminal on the speaker terminal strip to the *black* lead terminal

AIRLINE 811

Volume control inoperative or faulty	1)	change in value of the 25,000-ohm carbon resistor which connects from the common B-plus lead (or r-f plate supply lead) to the screens of the 1'st and 3'rd r-f tubes. (Another resistor (15,000-ohms) connects from this point to the 1'st and 3'rd r-f tube cathodes). Replace the 25,000-ohm carbon resistor with one of higher wattage rating.

AIRLINE 1955

Noisy reception, No control of volume on strong stations	1)	defective 8-mfd., 275-volt detector plate return filter condenser. Replace with new unit
Intermittent reception (tubes and voltages test O.K.)	1)	open-circuiting 0.01-mfd. coupling condenser connected between the plate of the oscillator tube and a lug on the oscillator coil. This condition can be checked by testing for oscillator signal. Replace with a new unit if necessary

AIR MASTER

(See also Case History listings under AUTOMATIC RADIO MFG. CO.)

AIR MASTER AC-DC

Distortion, Blasting, Poor tone at high volume levels	1)	decrease in capacity of one or both 8-mfd. filter condensers. The trouble usually occurs when their total capacity drops to less than 12-mfd.
Distortion on low volume (after set heats up), "Mushy" tone	1)	check '43 tube by replacing it with another (even though it tests O.K.)
	2)	check 0.01-mfd. condenser from screen of 6C6 tube, replacing it if necessary

ALL-AMERICAN MOHAWK (LYRIC)

ALL-AMERICAN MOHAWK (LYRIC)

Squealing or whistling	1)	leaky dual by-pass condenser
	2)	open-circuiting connections at one of the by-pass condensers

ALL-AMERICAN MOHAWK 70, 73, 75

Hum	1)	change location of grid leak, isolating it from the a-c filament leads so it will not pick up hum from them

ALLIED RADIO

(See Case History listings under KNIGHT)

AMERICAN BOSCH CORP.

(See Case History listings under BOSCH)

AMRAD

AMRAD AC-7

Hum, Noise, Low volume Intermittent reception	1)	test plate voltages at all r-f tubes and 1'st audio tube. If they are all low, test the continuity from B-plus side of 2'nd audio transf. to ground. If this ranges between only a few hundred ohms to zero, substitute new plate r-f by-pass condensers for the present ones (one at a time) until the continuity reads 3,000 ohms or more—which is the voltage divider resistance only. When the faulty condenser is located, replace it with a 0.1 to 0.5-mfd. unit

AMRAD 70

Hum	1)	often caused by breakdown in the 8-mfd. detector plate circuit by-pass condenser section of the dual condenser. Replace this section with a new 4-mfd. unit, placing it so it will not be heated excessively by the power tubes and rectifier tubes

AMRAD 81

Fading about 3 or 4 hours after being switched on, (no plate voltage on the detector tube when the above condition appears)	1)	defective 0.5-mfd. audio-coupling condenser (has two yellow leads coming from by-pass condenser block). Replace with a new externally connected coupling condenser
	2)	poorly soldered connection at the r-f coils. Test by tapping the coils slightly
Hum (hum balancers adjusted) ("Mershon" condenser tests O.K.)	1)	connect a 1-mfd. condenser from the cathode of the first a-f tube to ground, using leads as short as possible
	2)	try several tubes in the 1st a-f stage, making separate hum adjustments for each one
Hum (develops after about 30 minutes of operation)	1)	check the 4-anode 52-mfd. Mershon electrolytic condenser. Disconnect each wire separately from each anode of the Mershon, inserting a 0 to 10 milliammeter in series with it to measure the leakage current. If the leakage indicated is over 4 mils for any 8-mfd. anode, replace with a 400-volt condenser. If it is over 10 mils for any 18-mfd. anode, replace wtih a 4-mfd. 400-volt condenser. The 8-mfd. anodes are the two that are nearest the copper container
Hum	1)	defect in one of the two 18-mfd. wet electrolytic condensers. Try disconnecting each section, one at a time. If hum is reduced considerably when removing connection to one of the units, replace it with a 2-4 mfd. paper or dry-electrolytic condenser. It may be necessary to replace the entire unit
Volume control faulty	1)	poor connection between the lug on the volume control potentiometer and the chassis. Sometimes the potentiometer circuit opens at the "minimum" setting, causing intermtitent trouble of this kind

AMRAD 84

Fading	1)	the 0.1-mfd. condensers which are used to couple r-f coil sections to ground often become faulty. Locate the faulty one by direct substitution with a new one

(Cont'd over)

AMRAD 84—*(Cont'd)*

Squealing or whistling	1)	clean all rotor wiping springs and all shield contacts on the condenser gang. For permanent repair, install pigtail contacts between the rotor sections of the condensers and the chassis
Hum	1)	for hum developing after about 30 minutes of operation, replace the two 18-mfd. electrolytic sections of the filter condenser with paper condensers.

AMRAD 7100

Intermittent reception	1)	leads shorting in cabled wiring
	2)	a-f transformer leads shorting to chassis or shield
Fading	1)	corroded or loose fuse-block contacts
	2)	a-f transformer leads shorting to chassis
	3)	a-f transformer leads shorting to shield
Hum	1)	open-circuited center-tapped filament resistor across the type '27 tube
	2)	faulty electrolytic condensers
Hum at resonance	1)	out of neutralization

APEX

APEX "Aircell" Models

Speaker trouble	1)	speaker has dual-coil driving unit designed to operate directly in the plate circuit of the '33 output tubes. These windings develop faults if moisture penetrates them. Secure a replacement coil, and before installing it, coat it with insulating varnish and allow to dry thoroughly

APEX "Midget"

Volume varies erratically	1)	loose turns of wire on the volume-control resistance strip. Install a new 8,000-ohm control

APEX 7

See also Case Histories listed under U. S. Radio & Television 7

Inoperative (test reveals *negative* screen-grid voltage)	1)	0.1-mfd. condser in screen-grid circuit "leaky"
Intermittent reception	1)	intermittent "open" in 3,200-ohm cathode resistor for the '24 oscillator tube. Replace this resistor
Intermittent reception (on low-frequency end of dial only, perfect reception otherwise)	1)	filter condensers check O.K. on leakage test, but capacity is low. Measure the capacity, or, if a capacity meter is not available, try adding another condenser in parallel
Weak reception from about 550 to 800 kc	1)	in receivers above *Serial No. 1,074,054* the oscillator 600-kc trimmer has been omitted and is replaced by a fixed condenser. Often, this drops somewhat in capacity. In such cases, replace with approximately a 775-mmfd. mica type unit shunted by an 85-mmfd. trimmer. Adjust the trimmer for maximum signal at approximately 600 kc

APEX 7A

Unsatisfactory performance (all voltages normal, tubes test O.K.)	1)	replace the first detector-oscillator tube with a '24A, trying several tubes until a satisfying one is found
Reception cuts off after operating satisfactorily for a while (oscillator section ceases to function)	1)	"open-circuit" in one of the tapped portions of the oscillator "tank" coil (all operating voltages will check O.K. in this case
	2)	"open" 0.01-mfd. '24A oscillator tube cathode by-pass condenser (all operating voltages will check O.K.)
	3)	try substituting a 2,000-ohm resistor for the 3,200-ohm unit now in the cathode circuit of the '24A det.-oscill. tube. Also try a 0.005-mfd. by-pass
AVC action poor	1)	"open" 3,200-ohm Candohm resistor in the AVC plate lead. Replace with 10-watt resistor of the same value
Weak reception, Receiver difficult to align, Intermittent reception	1)	poor tracking or inability to obtain critical adjustment on any i-f trimmer indicates moisture absorption by the i-f transf. and oscill. coil. Remove same (first label all leads) and check leads for breaks or corrosion. Then drive out moisture in coils by baking

APEX 7D (Chassis 700)

Fading or Low volume	1)	voice-coil wires "shorting" together at the start of the coil due to vibration of the cone. Clean the coil and paint it with a quick-drying insulating lacquer. Keep wires apart as much as possible

APEX 8

Inoperative, Weak reception, Fading	1)	change in value of 50,000-ohm oscillator plate resistor. Replace with 2-watt unit.
	2)	drifting of i-f transformers due to moisture absorption
Volume suddenly drops or increases (often when a light is turned on)	1)	0.5-mfd. condenser connected between the r-f cathode and the grid returns of the r-f and i-f coils "opens." Replace with a 0.5-mfd. 400-volt condenser.
Intermittent operation	1)	remove the condenser filters from the grid returns of the AVC-controlled tubes. Replace with new 0.5-mfd. 400-volt condensers

APEX 8A

Distortion (after receiver has played for about 30 minutes, grid of '47 tube gets red hot)	1)	filament center-tap for '47 tube "open"
Distortion, Low volume, Motorboating with volume control at maximum setting	1)	faulty type '27 second detector tube
	2)	decrease in capacity of the 8-mfd. condenser across the output of the filter unit. Replace with new unit
Sudden increase (or decrease) in volume when a nearby light is turned on	1)	0.5-mfd. condenser connected between the r-f cathode and the grid return of the r-f and i-f coils "opens." Replace with a 0.5-mfd. 400-volt unit
Loud hum immediately after switch is snapped on	1)	open-circuited 8-mfd. cardboard electrolytic filter condensers. Replace with new units

(Cont'd)

APEX 8A—*(Cont'd)*

Fading	1)	faulty 0.04-mfd. coupling condenser between the plate of the type '27 second detector tube and the type '47 output tube. Replace with new unit

APEX 9A

Weak reception	1)	dial light socket "shorting" to the chassis
Squealing or whistling, Motorboating (voltages abnormally high)	1)	open-circuited 7,100-ohm voltage-divider section. Replace with new unit
	2)	faulty condenser across the filter output. Replace with new unit
	3)	connect a 0.5-mfd., 600-volt condenser between the i-f screen or cathode circuits and ground
	4)	loss of capacity in filter condensers. Replace with new units

APEX 9B

Weak reception	1)	dial light socket "shorting" to chassis

APEX 10 SERIES

See also Case Histories listed for Apex 8, Apex 8A, Airline 1955, and U. S. Radio & Television 10 receivers.

Inoperative (but operates O.K. if '27 AVC tube is removed from socket)	1)	check 1,800-ohm section of "Candohm" resistor at rear of chassis
Reception O.K. but volume cannot be reduced to low level	1)	check for "open" 8-mfd. 275-volt detector tube "B"-filter condenser
Hum, Volume control will not reduce hum to zero	1)	replace the 8-mfd. condenser under the resistance strip in the center of the chassis
Hum	1)	25,000-ohm second detector plate filter resistor "shorted"
	2)	short- or open-circuited 0.06-mfd. condenser connected across the filter choke
	3)	electrostatic shield in power transformer not grounded, or ground is "open"
Poor AVC action	1)	"gassy" '27 tube in first a-f stage. Gassy tube causes grid current flow, and a voltage drop occurs across the volume control. Replace with a new tube
Noisy	1)	the dry electrolytic condensers in this receiver are a common source of "noise". Substitute for these condensers one at a time—especially the 8-mfd. unit which by-passes the detector plate resistor
Intermittent operation	1)	faulty oscillator plate resistor. Replace with a 1-watt unit
	2)	faulty electrolytic filter condenser at input of filter system. Replace with 8-mfd. dry electrolytic unit

APEX 10-B

Inoperative, Distorted, Weak	1)	check the '47 filament winding of the power transformer for a "short" to the high-voltage circuit
	2)	replace the filament center-tap of the transformer winding with a resistor center-tap
	3)	test the bias resistor. Replace with a 425-ohm unit if faulty

APEX 12

Inoperative (r-f and i-f circuits "dead," but audio circuits operative (plate-to-cathode voltages on r-f and i-f tubes about 10-volts; chassis-to-cathode voltages about 250-volts)	1)	short-circuited turns on 4,600-ohm section of field coil of speaker *No. 2*. Rewind, or replace with new coil

APEX 20

Weak reception (all voltages normal)	1)	"open" 0.05-mfd. blocking condenser in the input circuit of the '24 detector stage. Replace

APEX 26

Inoperative (faint signals from local stations only), Weak reception, Poor selectivity	1)	short-circuited 0.4-mfd. screen-grid by-pass condenser. Replace with a 0.5-mfd. tubular unit
	2)	check grid wires for "chafed" insulation where they run through holes in chassis
Poor control of volume, Intermittent volume	1)	faulty volume control. Replace with a new 8,000-ohm unit
Squealing, or whistling (screen voltages way above normal)	1)	open-circuited 2,560-ohm resistor. Replace with 2,500-ohm, 20-watt unit
Squealing, or whistling (detector screen voltage high)	1)	replace 2640-ohm section of metal-clad resistor with a 2,500-ohm, 10-watt wire-wound resistor
Reception weak (no screen voltage on r-f tubes)	1)	check black wire at loud speaker for voltage. No voltage here indicates open tap in speaker field. Repair may be made by tapping screen voltage through a 1-watt resistor from the red lead that feeds the r-f transformer. Screen voltage should read about 80 volts after repair
Squealing or whistling, (all voltages normal)	1)	clean the "grounding" contacts between rotors of tuning condensers and chassis
	2)	replace r-f by-pass condensers, using 0.5-mfd. 400-volt units
Weak reception, Selectivity poor	1)	failure of the r-f stage to peak satisfactorily, indicates leakage or a partial "short" between the chassis and the wire that runs from the grid end of the secondary of the r-f transf. to the grid of the tube—at the point where the wire runs through the hole in the chassis. Replace the wire
Hum when receiver is switched on	1)	"open" 8-mfd. cardboard type filter condenser

APEX 26-P

Squealing, or whistling, Noisy reception	1)	primary winding of the antenna coil "open." Disconnect one end of antenna-to-ground resistor before testing
	2)	defect or partial "short" in the 2,640-ohm screen resistor

APEX 27

See also Case Histories listed for U. S. Radio & Telev. 27 receiver.

Squealing, or whistling (steady)	1)	clean the "grounding" contacts between rotors of tuning condensers and chassis
	2)	replace r-f by-pass condensers, using 0.5-mfd. 400-volt units
Intermittent squealing	1)	try increasing the r-f by-pass condenser capacity from 0.5-mfd. to 1.0-mfd.
Weak reception Selectivity poor	1)	see the Case History listed for this trouble under Apex 26 receiver
Part subject to frequent breakdown	1)	long metal-clad resistor at inside rear of chassis. Value of sections (beginning with that fed from filter choke): 4,700, 8,400, and 10,700 ohms

APEX 27P

See also Case Histories listed for U. S. Radio & Telev. 27 receiver.

Part subject to frequent breakdown	1)	long metal-clad resistor at inside rear of chassis. Value of sections (beginning with that fed from filter choke): 4,700, 8,400, and 10,700 ohms

APEX 28

Distortion	1)	if checkup reveals lack of plate voltage on one of the power tubes, check for an "open" in the audio choke which feeds the plate of that tube. This choke may be "shorted" out of the circuit if a temporary repair is desired
	2)	check two condensers in filter system
Inoperative (no plate voltage on tubes) (power transformer heats excessively)	1)	check filter condensers for "shorts"
	2)	if power transformer heats excessively, also check the rectifier leads for "shorts." Run them thru spaghetti tubing. Make sure power transformer has not been damaged by the excessive heating
Weak reception	1)	add small trimmer condenser to the receiver by connecting them from the stator terminals of the tuning condenser to ground. Then re-align the receiver

APEX 31

Inoperative	1)	pull out unshielded tube ('27) to check from 1'st a-f to output for response
	2)	no continuity between plate socket terminal of 1'st a-f and plate socket terminal of one of the '24 tubes indicates an open resistor section in the metal-clad resistor under the chassis. The small section is the one frequently found faulty. Shunt it with a 3,500-ohm resistor. (In making continuity tests, disconnect the leads to the strip.) The adjacent section is 8,400 ohms and the grounded section is 10,700 ohms
Rumbling noises	1)	tighten the r-f chokes just inside the r-f coils

APEX 32

Fading, Intermittent howling	1)	poor "grounding" of flat by-pass condenser can containing 6 condensers. Solder the can to the tube shields

APEX 36

Fades with a "plop" after 30 or 40 minutes of normal operation, (tubes and voltages check O.K. when operation is normal) (no plate voltage when fading occurs)	1)	double filter choke (which is sealed with the power transformer in a common pitch-filled can) slips down when the pitch is heated after set is in operation and touches the high-voltage terminal on power transformer. When the set cools, the contraction of the mass causes the contact to open. Heating, however, causes the same condition to repeat itself. Melt out the pitch from the can and insulate the choke and transformer from the sides of the can and from the high-voltage terminals. Reseal the unit
Weak reception at low-frequency end of dial. Normal or excessive volume at high-freq. end	1)	check the antenna choke for an "open." Replace it if necessary, and realign the receiver

APEX 41, 42

See also Case Histories listed for Airline AE-11 receiver

Squealing, or whistling over entire dial	1)	try connecting a 3,000-ohm resistor into the second r-f control-grid lead to act as a grid-suppressor

APEX 43, 44

Same Case Histories as those listed for Airline AE-11 receiver

APEX 46

See also the Case Histories listed for Apex 28 and Apex 48.

Distortion on low-volume setting (after tubes have been replaced)	1)	trouble of this kind can be overcome by replacing the old volume control with another unit connected in a slightly different way. The old one is simply a resistor in the cathode circuits of the 24's. For proper replacement install a 10,000-ohm tapered unit connected with one end to the antenna lead, the other end to the cathodes of the 24's through a 250-ohm resistor, and the slider to "ground" or chassis. The break in the wire-wound resistor where the old control was connected should be closed electrically with a jumper

APEX 47

See also the Case Histories listed for Apex 28 and Apex 48.

Inoperative (strong blue glow in '80 rectifier tube)	1)	cut out and tape the white lead coming out of the filter condenser block. Removal of this section of the condenser will not materially affect the operation of the receiver. However, if it is desired, another condenser can be connected externally to replace the one cut out

APEX 48

See also Case Histories listed for U. S. Radio & Telev. 48 receiver.

Inoperative (smoke issuing from power transformer)	1)	unsolder the rectifier leads and prevent future "shorts" by running them through "spaghetti" tubing insulation. Resolder them in place
No plate voltage on one of the '45 tubes	1)	audio choke "open." It may be "shorted" out of the circuit without material change in receiver performance
Inoperative (no plate voltage on screen-grid tubes)	1)	replace the 4,100-ohm plate resistor and check the 0.5-mfd. plate by-pass condenser

APEX 60, 60A

Same Case Histories as those listed for Airline AE-11 receiver

APEX 80

Weak reception (jarring the receiver brings it back to normal)	1)	faulty a-c receptacle of dynamic speaker, resulting in a loose connection and no field excitation current. Replace receptacle
Weak reception on one end of dial	1)	stator plates of tuning condenser have shifted out of alignment. Plates must mesh with similar spacing at top and bottom of plates
Squealing, or whistling at certain dial settings	1)	connect a 500-ohm non-inductive resistor directly into the grid lead of the second r-f tube. Also connect a 250-ohm resistor at grid end of the third r-f tube

APEX 99

Weak reception	1)	4- and 8-mfd. filter condensers "open," or lowered in capacity
Distortion when volume control is turned up	1)	check 4-mfd. electrolytic condenser for "open"
	2)	if 47 tube is weak, and other tubes are O.K., check the 400,000-ohm resistor connected from the 47 tube grid to the voltage divider for change in value, or "open" (causing high plate current)

APEX 99A

Intermittent reception (receiver operates only when the "on-off" switch is snapped, or when one of the house lights is turned on)	1)	if reception is restored by touching the plate leads of the first detector, i-f leads, or oscillator leads, check for a faulty detector cathode by-pass condenser

APEX 120

Same Case Histories as those listed for Apex 12 receiver

APEX Chassis 700

See Case Histories listed for Apex 7D

ARBORPHONE

ARBORPHONE (General Service Notes)

Weak reception, Noise	1)	inspect all r-f grid-return leads at the chassis for corrosion. Install a common ground wire connected to all the grid-return leads
	2)	crackling or frying noises are often due to a faulty first a-f transf. primary. Replace with a new transformer
Hum (no grid voltage)	1)	grid resistor burned out due to an internally-shorted tube
	2)	center-tapped resistor connected across the 1.5-volt filament winding "shorts" to the chassis, producing the same effect
Noisy or intermittent when tuning	1)	broken lead on tickler coil. Replace with a more flexible lead. Tickler coil is mounted on a cam which moves in synchronism with the tuning condensers

ARBORPHONE 45

Fading, Insufficient selectivity	1)	clean and solder the rivets that are used on the "balancing panel" located under the chassis. Rebalance the receiver
Inoperative, Intermittent reception	1)	fraying and breakage of leads to tickler coil in '27 detector plate circuit. Replace with high-grade flexible wire, bending coil as close to r-f coil as possible without causing oscillation
	2)	"opens" in grid resistances, or "corrosion" at terminals. Replace with 600-ohm flexible pigtail type resistor, or with 400- to 500-ohm units for greater sensitivity
	3)	r-f coil grid-return wires to chassis loosen frequently. Connect a common ground to each coil, and connect to ground post
	4)	bias condenser at right of '80 tube socket loosens where bolted in place
Hum	1)	interaction between '80 rectifier and '27 detector tubes. Place a piece of sheet copper or aluminum about 3 inches square behind the license notice plate in front of the rectifier
Increasing sensivity and improving general operation	1)	replace the '27 tube with a '56 type tube
Squealing, or whistling	1)	excessive filament voltage caused by improper setting of line-voltage tap. Set the tap in the "high-voltage" position
	2)	bend the cam which holds the tickler coil, so that it will be farther away from the detector grid coil

---

ARGUS

ARGUS (Models using 99's and 81's)

Weak reception (filament voltage below normal)	1)	if the filament voltmeter does not come up to 3 volts quickly, check for deterioration of the old style electrolytic condenser located inside the small black metal case in the power unit. Replace it with a new dry-electrolytic condenser having three sections of 8-mfd. each, and a 500-volt rating

---

ARVIN

ARVIN 1934 Auto Radio Sets

Excessive hum	1)	pickup of vibrator interference by second i-f coil, as a result of the yellow wire from the volume control to power supply unit running near it. Move it away as far from i-f transformer as possible

ARVIN 1935 Auto Radio Sets

Poor quality, Low volume	1)	loose plug where the local-distance change is made. Repair plug, or replace with new unit
Excessive vibrator hum	1)	move the large yellow "A" lead running from the volume-control switch to the power supply compartment as far as possible from the second i-f coil. Shielding this wire also helps a great deal

ARVIN 1936 Auto Radio Sets

Vibrator hash

1) make sure that chassis is well grounded to firewall of car, using shakeproof washer on bolt
2) be sure to secure good grounding for the transmission line box. Ground it to the frame of the car if an under-car antenna is used, or, if a "top" type antenna is used, ground the box to some metal part known to be at the same r-f potential as the firewall. Make sure that the transmission line shielding is making firm contact with the plugs at both ends
3) remove front cover of receiver, and tighten the four screws holding the power transformer in place. Wiggle the vibrator in the socket, and make certain that each "grounding" tooth makes good contact with the sides of the vibrator case
4) in addition to regular A-line condensers, try connecting a 1-mfd. condenser across the car's A-circuit by connecting it from "ground" directly to either terminal of the ammeter or fuse block
5) solder a 1½-inch piece of shielding or flexible wire from the 6A7 grid cap tube shield to the frame of the variable condenser
6) vibrator "hash", which may occasionally increase to an undesirable level after a period of operation, may often be corrected by tightening the four screws that hold the power transformer to the chassis after the receiver has been allowed to warm up for a period of about a half hour

Mechanical hum in vibrator

1) In some of the first few 1936 receivers delivered, a mechanical noise develops due to chattering of the vibrator against the chassis. Remove the vibrator from the set and increase the tension of the vibrator-grounding spring cup which is riveted in the radio chassis over the vibrator socket

Switch remains in "on" position

1) remove the small stop pin located just above the volume control on the rear of the remote-control head. This pin may be extracted by prying it up with a screwdriver and removing it with a pair of pliers

ARVIN 1937 Auto Radio Sets

Vibrator hash

1) first warm up the set by playing it for 30 minutes. Then tighten the 4 screws which hold the power transformer to the radio chassis. This will effectively eliminate most vibrator interference
2) cut the grounding braid connecting the tuning condenser to the radio chassis (this particular grounding braid is located close to the point of entry of the tuning flexible shaft). Do not cut any other grounds on the tuning condenser, as this might introduce motor noise

Mechanical hum (vibrator chatters against chassis)

1) remove vibrator and increase the tension on the vibrator grounding spring cup

ARVIN 1940 Auto Radio

"Rattling" sound

1) dress the speaker cables to the side of the chassis away from the driver stage to prevent feedback

ARVIN A2 Antenna

Proper method of installation for motor noise elimination

1) the Arvin Type A2 antenna should always be installed on the front door hinge on the same side of the car on which the radio chassis is installed

Drill a 7/32-in. hole to accommodate the lead-in wire. The hole should be drilled in the door sill close to the door hinge in such a manner that when the door is closed the hole through which the lead-in passes is covered by the front edge of the door

The "Phantom Filter" box should be *securely grounded* to the instrument panel or the metal part of the dash *close to* the point of entry of the antenna leading into the car

Shield the antenna lead wire from the "Phantom Filter" to the point where the lead passes out of the car. Ground one end of the shield to the "Phantom Filter." Ground the other end to the automobile chassis or body

If motor noise is present after the antenna is installed in this way, it is generally caused by the car hood being ungrounded and may be remedied by placin a 6-in length (or longer, if necessary) of braided shielding over the fabric strip attached to the cowl on which the rear edge of the hood rests. Solder both ends of the braid to the cowl and if the fabric hood strip is fastened in place by metal screws, remove these and drive them through the shielding to hold it in a permanent position. Clean the paint off the hood at the spot where it rests on this braided shielding so that it will be securely grounded

Usually no suppressors—not even distributor type—are needed if the foregoing instructions are followed

ARVIN 6 (Serial No. 85001 to No. 86001)

Squealing, or whistling (between 1100 and 1500 kc)

1) connect a 20,000-ohm ¼-watt resistor in the B-plus lead to the oscillator. Also connect a 0.002-mfd. condenser from the B-plus leg of the oscillator coil to ground

ARVIN 7 Auto Radio

Intermittent reception, Squealing or whistling, "Put-put" (motorboating) sound

1) replace twin AVC condenser between the 6F7 tube socket and antenna coil in the Arvin 17, 27 and 37 receivers (this is between the '78 tube socket and the antenna coil in the Model 7 receiver. In the Model 17, 27 and 37 receivers, it is between the '78 socket and the antenna coil)

Squealing, or whistling while tuning

1) condensers *No. 17-4731* and *No. 17-4712* making poor ground contact through metal collar to chassis. Replace with new types, *No. 17-14020* and *No. 17-14007*, which have separate ground leads

Ignition noise

1) ungrounded cables. Ground all cables

ARVIN 10A

Intermittent reception

1) poor contact where the *brown* lead connects to each i-f transformer

Noisy

1) loose i-f shield cans. Install lock-washers under screw heads

Hum (after replacing '84 tube)

1) install a metal shield over the tube and ground

(Cont'd)

ARVIN 10A—*(Cont'd)*

Howl (when set is cold)	1)	reverse the primary leads to the reflexed audio transformer
Howl	1)	check the 12-mfd., 25-volt electrolytic condenser. Replace if faulty
Production changes (incorporated in more recent productions of the model—for improved performance)	1)	a 200-ohm, ¼-watt resistor *(R14)* has been added in the power pack across the vibrator points
	2)	the 100,000-ohm, ¼-watt resistor *(R3)* in the 6A7 No. 1 grid circuit has been changed to 50,000 ohm, ¼ watt *(R29)*
	3)	a bayonet-base pilot light is used instead of the one with a screw base
	4)	a 4-prong speaker-plug socket is used instead of the 3-prong socket
	5)	an ammeter cable and fuse has been added
	6)	it was found necessary to change the mechanical design somewhat to eliminate the possibiltiy for motor noise pickup at the point in the receiver case where the local-distance plug and tone-control plug were attached. This change is made beginning with the sets from which the louvres were omitted

ARVIN 16 Auto Radio

How to increase sensitivity in districts where signal strength is abnormally low	1)	remove inter-channel noise-suppression feature by disconnecting resistor *R-7* (the resistor in series with the second-detector cathode) at point *A* and reconnecting it directly to the cathode of the second detector tube. Thus the diode plates will no longer be biased, and the sensitivity will be slighty increased

ARVIN 17 Auto Radio

See also Case Histories listed for Arvin 7

Squealing, or whistling (while tuning)	1)	poor "ground" contact through metal collar to chassis on condensers *No. 17-4731* and *No. 17-4712*. Replace with new type *No. 17-14020* and *No. 17-14007* condensers equipped with separate ground leads
Ignition noise	1)	check to see that all cables are properly "grounded"
Hum	1)	replace original triple 4-mfd. electrolytic filter condenser with a triple 8-mfd. section. This can be obtained in a single can to fit in the original mounting. Connect two 8-mfd. sections to cathode of the 84 tube. Connect the remaining section to the connection from which the original 4-mfd. unit was removed
Circuit improvement	1)	the performance of early-run models of this receiver may be improved by changing the 100,000-ohm ¼-watt resistor *(R3)* in the 6A7 No. 1 grid circuit to a 50,000-ohm ¼-watt unit
Inoperative at low-frequency end of dial	1	replace 40,000-ohm resistor in series with oscillator screen

ARVIN 18 Auto Radio

Distorted, mushy tone, Weak reception when jarred	1)	faulty 0.05-mfd., 160-volt condenser (mounted through chassis near the power pack) connected from the volume control to the resistor on the end of the second i-f transformer

ARVIN 19 Auto Radio

Motor interference which persists even if antenna is disconnected from receiver	1)	this interference is caused by chassis pickup. Remove the radio chassis front cover and sandpaper the rim of the cover to remove all grease and paint
	2)	ground the shield of the '78 or 6A7G tube, and ground the shielding partitions in the tuning condenser. Use narrow copper braiding to ground these to the chassis
Raspy noise when dialing	1)	remove ground finger springs at each end of gang condenser rotor. Replace with new type of heavier construction

ARVIN 20 Auto Radio

Receiver operates for a while, then goes "dead"	1)	check the 0.05-mfd. r-f and i-f grid-return condensers for "opens"

ARVIN 20A Auto Radio

Inoperative	1)	inspect r-f chassis unit and if the tube heaters are not lit, repair the broken "A" choke in the audio unit
	2)	if the tubes in the r-f chassis light up but the vibrator is not heard, check this same choke for a break at the opposite end
Receiver cuts out	1)	check 0.05-mfd. r-f and i-f grid return coupling condensers for "opens"
Receiver overloads on powerful local signals	1)	replace the '75 tube with an '85 tube. This will reduce the sensitivity somewhat, but will improve the tone

ARVIN 25 Auto Radio

Inoperative	1)	short-circuited tone control (*Note*: this is a tapped condenser-type unit)
Intermittent reception	1)	replace dual 0.015-mfd. antenna coupling condenser
	2)	try a new 6A7 oscillator tube—one that will function satisfactorily over the entire tuning range of the receiver.
No reception, Vibrator sounds weak	1)	"shorted" dual 0.02-mfd. condenser used as a buffer across power transf. sec.
Noisy (after operating for an hour or so)	1)	partially shorted 0.05-mfd coupling condenser

ARVIN 27 Auto Radio

See also Case Histories listed for Arvin 7 and 17 receivers

Low volume (with a type '6B7 second detector and amplifier tube)	1)	change the value of the 200,000-ohm type '6B7 tube plate resistor to 300,000 ohms
Intermittent reception, Intermittent Squealing, or whistling	1)	intermittent or high-resistance connection between the bodies of the metal-can condensers and their mounting flanges. Bond the condenser bodies to their flanges with solder
High-pitched audio squeal	1)	"open" oscillator section in twin 0.05-mfd. by-pass condenser (*C17A* and *C17B*) by-passing the grid return from the r-f coil to the 78 tube and the grid return to the 6A7 oscillator circuit. Replace twin unit

(Cont'd over)

ARVIN 27 Auto Radio—*(Cont'd)*

Production changes (incorporated in more recent productions of this model—for improved performance)

1) the 100,000-ohm, ¼-watt resistor *(R3)* in the 6A7 No. 1 grid circuit has been changed to 50,000 ohm, ¼ watt *(R29)*
2) a 1000-ohm, ¼-watt resistor *(R24)* has been inserted in the 6A7 No. 1 grid circuit
3) the 400-ohm, ¼-watt resistor *(R2)* has been changed to 500 ohms, ¼ watt *(R10)*. Allowable variation in *R2* is from 200 to 600 ohms. Allowable variation in *R10* is from 400 to 600 ohms
4) the 500-ohm, ¼-watt resistor *(R10)* in the cathode of the 78 tube has been changed to 1500 ohms, ¼ watt *(R28)*.
5) the condensers *C12* and *C26* have been combined into one dual unit with capacities of 0.006-mfd., 800-volt and 0.25-mfd., 400-volt, respectively. The lead with the red dot is the 0.006 unit
6) a suppression choke *(X5)* has been added in the "A" lead. A 0.002-mfd. mica condenser *(C6)* is used ahead of the choke
7) a bayonet-base pilot light is used instead of the one with a screw base
8) a 4-prong speaker-plug socket is used instead of the 3-prong socket
9) an ammeter cable and fuse has been added
10) it is found necessary to change the mechanical design somewhat to eliminate the possibility for motor noise pick-up at the point in the receiver case where the local-distance plug and tone-control plug were attached. This change is made beginning with the sets from which the louvres were omitted
11) beginning with serial *No. D44011H* the type 75 tube was replaced with a 6B7; triode-connected
12) the 0.003-mfd., 600-volt condenser *(C25)* was changed to 0.006 mfd., 600-volt *(C26)*
13) beginning with serial *No. E45219H*, the triode connection on the 6B7 was changed to a pentode connection. The changes indicated below were therefore required
14) a 0.25-mfd., 400-volt condenser *(C12)* was added as a screen by-pass from the screen of the 6B7 tube to ground. A 1-megohm, ¼-watt resistor *(R9)* was added as a screen-dropping resistor from B-plus to the screen of the 6B7 tube. The 0.006-mfd., 600-volt condenser *(26)* was changed to 0.003 mfd., 600 volt *(C25)*
15) under the conditions outlined above, voltages on the 6B7 are approximately: plate, 60; screen, 30 and cathode, 1.7 volts. A 1000-ohms-per-volt voltmeter was used for these measurements

ARVIN P28 to P45 Auto-Radio Remote Controls

Backlash

1) misalignment between dial mechanism and dial drive member. The small flexible shaft linking the two assemblies must not make two bends. Thin washers are used to line up these members into which the shaft is inserted
2) play in worm-gear drive mechanism. This may be removed by tightening the small hex adjusting nut to the point where no backlash is perceptible
3) kink in small dial drive flexible shaft. This small shaft must be straight and free from kinks. Otherwise backlash will be noticed on one end of the dial and not on the other

(Cont'd)

ARVIN P28 to P45 Auto Radio Remote Controls—*(Cont'd)*

Backlash —*(Cont'd)*

4) excessive or insufficient amount of shafting connecting dial to tuning member. When the small link flexible shaft is either too short or too long, the curve it assumes is beyond its elastic limit and the detrimental effect is similar to that caused by a kinked shaft

ARVIN 29 Auto Radio

See also the Case Histories listed for Arvin 19 Auto Radio.

Squealing, or whistling (when volume is turned on full and tone-control is at the low-pitch setting)

1) move the r-f by-pass condenser which is in the plate circuit of the 6A7 tube to a new location behind the shield. The red lead goes to the B+ line. (Receivers bearing serial number above *A28200B* have already had the 0.1-mfd. condenser changed to the new location
2) some 6Q7G tubes have very high gain and are responsible for this oscillating condition. Often, changing this tube remedies the oscillating condition
3) another possible remedy (if the plate by-pass condenser mentioned in section 1 is not changed) is to replace the 6V6G output tube with one having a mutual conductance of 3200 to 3800 micromhos. Often a 6V6G tube has a particularly high gain which contributes to an oscillating condition in a certain receiver

ARVIN 30A Auto Radio

Same Case Histories as those listed for Arvin 20A Auto Radio

ARVIN 32

Hum, Vibrator noise

1) remove ground clip and lead which grounds end of tuning condenser nearest the gearing to the outside case
2) disconnect volume control ground-return lead from the lug on the oscillator coil to which it was originally connected. Extend this lead, and ground it to the "ground" lug of the 6X5G rectifier tube located in the power pack
3) replace 6Q7G cathode by-pass condenser with a 10-mfd. 25-volt unit

ARVIN 35 Auto Radio

Poor tone

1) replace both 0.01-mfd. audio-coupling condensers with mica-moulded condensers of the same value

ARVIN 37 Auto Radio

Same Case Histories as those listed for Arvin 7 Auto Radio

Circuit improvement

1) the performance of early-run models of this receiver may be improved by changing the 100,000-ohm ¼-watt resistor *(R3)* in the 6A7 No. 1 grid circuit to a 50,000-ohm ¼-watt unit

ARVIN 39 Auto Radio

Same Case Histories as those listed for Arvin 19 Auto Radio

ARVIN 41 Auto Radio

Distortion at low volume-control settings, and on strong signals

1) overbias on type '6F7 tube grid. Remove the 100-ohm resistor from the cathode circuit of this tube, and connect the cathode to ground through an 800-ohm resistor. The volume control will then affect the bias on the 6A7 tube only, rather than on both this tube and the '6F7. Fix-bias the latter independently

ARVIN 42 Auto Radio

See also Case Histories listed for Arvin 32 receiver

Distortion (when used with *E9*, *E10*, separate-case speakers	1)	see if nuts holding speaker grille name plate in place have loosened up
	2)	unbalanced triode sections in 6N7G tube. Replace the tube

ARVIN 44 Auto Radio

Vibrator "Hash"	1)	solder a strip of braid shielding from frame of condenser gang to chassis

ARVIN 51 Auto Radio

Same Case Histories as those listed for Arvin 41 receiver

ARVIN 62 Auto Radio

Noisy (when tuning dial is rotated)	1)	solder the bottom arm on the planetary drive system to the bracket at the bottom front end of the condenser gang

ARVIN 65 Auto Radio

Ignition interference	1)	clean surface joints on front cover of receiver to remove all paint and grease
	2)	check the "acoustinator" plug to see that good grounding contact is obtained
	3)	check the right-hand breather screen for ground. "Spot" it with solder to the housing

ARVIN 81M Auto Radio

Hum	1)	remove push-pull audio input choke from top of chassis and mount it underneath. Try rotating to different angles while the receiver is operating, to find the minimum hum position. Then mount it in that position

ARVIN 510 Auto Radio

Same Case History as that listed for Arvin 44 Auto Radio

ARVIN 617 Auto Radio

Crackling, Flickering pilot lights	1)	dial frame is not properly grounded to receiver chassis. Run a short, flexible lead between the two, and solder it securely in place

ARVIN 618 Auto Radio

Hum (steady, or intermittent)	1)	high-resistance contact (which may check O.K.) between chassis and ground lug riveted to 6Q7G tube socket. Bend this lug over and solder it securely to the chassis

ARVIN 818, 828 Auto Radios

Hum	1)	unsolder the 250,000-ohm plate resistor of the 6F5G tube from the *Max. B+* terminal (this is the lug on the 16-mfd. 300-volt electrolytic condenser). Now connect this resistor to the first tap down from *Max. B+* on the voltage divider resistor (the tap which supplies potential for the 6A8G anode grid)

ARVIN 927

Faulty performance of 6G5 Magic Eye	1)	first check the 1megohm resistor (contained within the 6G5 socket assembly) for an "open" condition
	2)	if foregoing test does not reveal trouble, check the AVC network

ARVIN 1237

Inoperative	1)	check for "short" in moulded bakelite by-pass condenser in first i-f transformer
	2)	also replace the 1,000-ohm plate-dropping resistor in this circuit
"Bass" too pronounced at low setting of volume control	1)	remove the bass-compensating connection on the volume control. This consists of an 18,000-ohm resistor in series with a 0.03-mfd. condenser

ARVIN 1427

See also Case Histories listed for Arvin 1237 receiver.

Station shift on push-buttons	1)	replace original fibre oscillator-trimmer strip with new isolantite type. Seal the trimmers after adjusting

---

ATWATER KENT

ATWATER KENT (General Servicing Data)

Flat ribbon tuning drives	1)	these flat ribbon belt drives can be replaced with phosphor bronze dial cable. Solder the cable to the pin on the pulley that originally went thru the belt
Noisy volume control	1)	many noisy volume controls can be repaired by simply removing them from the chassis, swabbing the winding with a cloth saturated with alcohol or Carbona, and bending the slider arm so it makes firmer contact with the resistance winding. Also tighten it against the tension spring

ATWATER KENT ALL-WAVE BATTERY RECEIVERS

Poor quality, High battery drain, Oscillation	1)	leaky 8-mfd., 200-volt electrolytic condenser connected to B-plus. Replace with new unit of higher voltage rating

ATWATER KENT "D", "F", CHASSIS

Same Case Histories as listed for Atwater Kent 70 receiver

ATWATER KENT H-1, H-2

Inoperative	1)	open-circuited antenna choke
	2)	short-circuited i-f trimmer condensers. Replace mica dielectrics and re-align the i-f amplifier

ATWATER KENT "L" CHASSIS

See also Case Histories listed for Atwater Kent 70 receiver

Inoperative, Whistling	1)	dirty or corroded connections at rotor spring contacts on the condenser gang. Clean and increase tension of springs or solder flexible pigtails between the rotor and the condenser frame
Whistling (sensitivity switch in "local" position)	1)	coupling between wire leading to switch and r-f choke. Bend this wire away from the coil opening
	2)	coupling between the *red* wire from the switch and the r-f coils. Move the wire away from vicinity of coil openings
Inoperative (no voltage) on the detector or first audio tube	1)	burnt-out filter resistors
	2)	short-circuited condensers
	3)	burnt-out plate circuit resistors
	4)	burnt-out input transformer

ATWATER KENT L1

Distortion, Hum — 1) bias resistor for the '45 output tubes "open"

ATWATER KENT "P" CHASSIS

See also Case Histories listed for Atwater Kent 70 receiver

Whistling, Distortion — 1) shunt a 0.00015-mfd. condenser from plate to cathode of first r-f stage if oscillation occurs when old 24 tubes are replaced by new ones
2) check r-f screen voltage in all three stages. If it is above 85 volts with volume control full on, insert a suitable voltage-dropping resistor between the volume control and screens

ATWATER KENT "Q" CHASSIS

See also Case Histories listed for Atwater Kent 70 receiver

Audio howl — 1) shunt the secondary of the first a-f transformer with a 100,000-ohm resistor. Shunt the secondary of the push-pull input transformer with a 150,000-ohm resistor

ATWATER KENT 2

Receiver goes dead suddenly while operating — 1) replace the double-pole double-throw toggle switch for a new one

ATWATER KENT 7-D

Squeals at low volume — 1) leaky condenser *C18*. Replace with an 8-mfd., 400-volt unit
2) open-circuited section in i-f transformer *T5*. Replace with new unit

ATWATER KENT 30

Poor sensitivity, Poor selectivity — 1) replace antenna coil with a compensator coil; i.e., a center-tapped coil, connecting one end to grid, the other to ground, and the tap to the antenna terminal. If oscillation occurs now, increase resistance of grid resistors

Set "dead" — 1) test the speaker filter condenser. Replace with a 0.5-mfd. paper-dielectric unit
2) wire-wound plate resistor under chassis "shorted" to ground. Trouble caused by warping of fibre base. Slide a piece of fibre or insulating paper under the unit

Weak, or no reception — 1) fibre base of resistor under chassis warped, causing resistor element to "short" to ground. Slide a piece of fibre or stiff cardboard under unit to straighten it

ATWATER KENT 35

Lack of volume — 1) drill out one eyelet from the support bracket of the second r-f transformer. Turn the coil just far enough out of line to keep the set just under the oscillating point at the high-frequency end of the dial
2) same Case History as listed for "Poor sensitivity," "Poor selectivity" under Atwater Kent 30 receiver

ATWATER KENT 36

Hum — 1) often caused by loosened nuts on the grounded posts of the power pack terminal strip. This opens the filter condenser circuits. Tighten these nuts

ATWATER KENT 37, 38

Inoperative — 1) short-circuited filter condenser
2) short-circuited speaker output condenser. Test quickly by checking plate voltage at '71A tube socket. If it is low disconnect one speaker lead and plug analyzer test plug into '71A tube socket. If plate voltage is now at normal value, replace the speaker output condenser
3) short-circuited r-f by-pass condenser (for Model 37 only)

Weak reception — 1) open-circuited first a-f plate resistor
2) open-circuited detector plate resistor
3) tuning belts loose
4) tuning condensers not synchronized
5) Connect a 1-mfd., 400-v. condenser between filament of 280 tube (where it connects to the first filter choke) and ground. Necessary to open the cans to do this. Also reduces hum

Weak and distorted signals — 1) if output tube plate voltage is low (or zero), check speaker filter condenser for full or partial "short" by disconnecting the speaker. If this makes the plate voltage and current of the output stage increase to normal, replace this speaker filter condenser with a 0.5 or 1.0-mfd. 400-volt paper-dielectric unit
2) if there is no detector plate voltage, check the resistor located under the cable template in the power pack—the one which connects the two lugs on the end of the template where the cable joins it
3) dirty volume control. Clean with alcohol

Intermittent reception — 1) loose nuts on power pack terminal strip
2) antenna lead short-circuiting to shielding braid
3) Press down rear of chassis. If this causes noise, insulate shielded antenna cable leading from reaf of cabinet to front of chassis, so it cannot touch the bare ends of the power cable (for Model 37)

To improve sensitivity — 1) same Case History as listed for "Poor sensitivity," "Poor selectivity" under Atwater Kent 30 receiver
2) connect a 1-mfd. 400-volt condenser between filament of '80 tube (where it connects to the first filter choke) and ground. This will increase the filter output voltage, reduce hum, and give the receiver more pep. (It is necessary to open the cans to make this alteration)

To increase selectivity — 1) mount a 3-gang trimmer on top of the tuning gang and re-balance with these trimmers connected across the individual tuning condenser sections. Make sure that the rotor section of the tuning condenser is well grounded
2) decreasing the resistance value of the suppressors for the 2'nd and 3'rd r-f tubes, from 800 ohms down to 500 or even 400 ohms helps. This introduces a slight amount of regeneration and increases both the selectivity and the sensitivity

Noisy reception — 1) loose nuts on power pack terminal strip
2) defective volume control resistance strip
3) dirty volume control resistance strip and contacts (for Model 37 only). When installing new volume control strip, first connect it (in series with a 75-watt lamp) across the 110-volt line for about 1 minute. The heat produced will make the strip pliable so it can be inserted in the shell easily and without breakage

(Cont'd)

ATWATER KENT 37, 38—(*Cont'd*)

Hum
1) often caused by loosened nuts on the grounded posts of the power pack terminal strip. This opens the filter condenser circuits. Tighten these nuts
2) connect a 1-mfd. 400-volt filter condenser across the filter input that is between the '80 filament and ground

Inoperative, Choked reception (no grid voltage)
1) "open" grid-suppressor resistor (located on stators of the tuning condenser). May be replaced by any type resistor between about 500 and 1,000 ohms—800 ohms being about the usual best size

"Choppy" or "noisy" reception in Model 38 receiver
1) test for "shorted" speaker filter condenser by detaching the *green* wire with the *yellow* tracer from the bottom terminal strip and connecting new 0.5-mfd. paper-dielectric condenser in series
2) noisy operation of volume control usually due to broken lead in r-f primary near the lug
3) if trouble appears when condenser gang is rotated, dismount and clean the gang
4) "steady" noise is frequently due to either or both of the cylindrical resistors in the power unit going bad

Squealing, or whistling
1) faulty grid suppressors cause r-f squeals
2) try new r-f and detector tubes. If oscillation persists fasten a thin brass, copper, or aluminum shield about 1½ inches square between the first and second stage tuning condensers. Bend it in the form of an "L", bolting the narrow foot in place

ATWATER KENT 40

Inoperative
1) open-circuited 625-ohm r-f and a-f bias resistance section and 2,200-ohm type '71A bias resistance section. Replace with new resistance units
2) shorted r-f by-pass condenser
3) check 0.3-mfd. speaker by-pass condenser
4) fibre base of resistor under chassis warped, causing resistor element to "short" to ground. Slide a piece of fibre or stiff cardboard under unit to straighten it

Weak, or no reception, Fading
1) fibre base of resistor under chassis warped, causing resistor element to "short" to ground. Slide a piece of fibre or stiff cardboard under unit to straighten it
2) shorted speaker output condenser. Check plate voltage at '71A tube socket. If it is low, disconnect one speaker lead and plug analyzer test plug into '71A tube socket. If plate voltage is now normal, replace speaker output condenser
3) open-circuited detector plate resistor, or 1-mfd. plate by-pass condenser
4) open-circuited first a-f resistor
5) tuning belts loose
6) defective glass tube grid leak resistor. Replace it with a carbon pigtail type resistor unit
7) filament voltage at '26 tubes low. Wire in two additional filament leads from power pack to filament lugs of first r-f tube socket. This will reduce the voltage drop in the filament line and raise the filament voltage on the '26 tubes. Especially effective when '26 tubes are old

(Cont'd)

ATWATER KENT 40—(*Cont'd*)

Weak or no reception, Fading —(*Cont'd*)
8) connect a 1-mfd., 400-v. condenser between filament of 280 tube (where it connects to the first filter choke) and ground. Necessary to open the cans to do this. Also reduces hum
9) poor connection between flat-type antenna coil and its lug. Resolder connection
10) detector grid condenser short-circuiting to tuning condenser frame. Mount the condenser rigidly or wind tape around its free end
11) receiver tuning circuits out of alignment. Realign circuits, installing a 3-gang trimmer across the tuning condenser sections for better alignment if necessary

Choked reception, Distorted and weak
1) short-circuited or leaky speaker output condenser
2) open-circuited detector plate resistor
3) connect a 450-ohm resistor across the plate and grid of the first audio 26 tube

Intermittent reception
1) loose nuts on power pack terminal strip
2) volume control slider arm contact "poor"
3) antenna lead short-circuiting to shielding braid

Squealing, or whistling
1) faulty grid suppressors
2) try replacing r-f and detector tubes
3) if oscillation persists, fasten a thin brass, copper, or aluminum shield about 1½ inches square between the first and second stage tuning condensers. Bend it in the form of an "L," bolting the narrow foot in place

Howl (during warming-up period)
1) try a quick-heater type detector tube
2) try reversing the *blue* and *black* wires on secondary of 1'st a-f transformer
3) shunt a 250,000-ohm resistor across the secondary of the first a-f transf.

Excessive hum
1) check for a poor joint between the "ground" terminal under the resistance strip in the power pack, and the wire which goes from this terminal through the insulating compound into the power pack
2) check for loose nuts on the power pack terminal strip
3) extremely bad a-c hum may be caused by an "open" filter condenser. If it is the detector filter condenser, it may be checked by removing the *yellow* lead (which connects to the cable supply panel) and connecting a 1-mfd. condenser between this point on the panel and the center post (which is grounded)

Noisy reception
1) defective or dirty volume control resistance strip. Clean with alcohol and adjust contact arm—or replace unit. When installing new volume control strip, first connect it (in series with a 75-watt lamp) across the 110-volt line for about 1 minute. The heat produced will make the strip pliable so it can be inserted in the shell easily and without breakage
2) intermittently open-circuiting 6,500-ohm detector plate resistor. Replace with new unit

Noisy reception with "crackling"
1) loose connection in r-f plate circuit between bias resistor and ground
2) defective "flat" type wire-wound cathode. Replace tube

(Cont'd over)

ATWATER KENT 40—(*Cont'd*)

Noisy reception while tuning	1)	remove complete condenser gang assembly from chassis and wash in gasoline, cleaning all contact points
Inoperative, Choked, erratic operation	1)	"open" grid-suppressor resistor (located on stators of tuning condenser). May be replaced by any type resistor between about 500 and 1,000 ohms — 800 ohms being about the usual best size
Fading	1)	tighten all the nuts on both terminal boards in the power supply unit

ATWATER KENT 41

Inoperative	1)	burned-out tube (check each one—series-filament connection used)
	2)	one or both r-f chokes in series with either side of line has "opened" (located beneath terminal strip in power pack. Repair by rewinding the bobbins full of No. 22 double-cotton covered or enameled wire
Weak reception, Broad tuning	1)	tuning belts loose
	2)	tuning condensers not synchronized
	3)	remove 1st r-f plate resistor (located near the tube and antenna coil) from circuit. Close the plate circuit after removing this resistor
Hum at resonance	1)	open-circuited r-f filament by-pass condenser
Noisy reception	1)	defective, or dirty, volume control resistance strip. Clean with alcohol and adjust contact arm—or replace unit. When installing a new volume control strip, first connect it (in series with a 75-watt lamp) across the 110-volt line for about 1 minute. The heat produced will make the strip pliable so it can be inserted in the shell easily and without breakage

ATWATER KENT 42

Same Case Histories as those listed for Atwater Kent 37, 38 and 40

ATWATER KENT 43

See also Case Histories listed for Atwater Kent 40

Inoperative, Weak reception	1)	open-circuited detector or first-audio resistor
Inoperative (tubes do not light)	1)	voltage-regulating resistor burned out
Intermittent reception	1)	broken voice-coil lead at soldered joint
	2)	loose nuts on power pack terminal strip
	3)	antenna lead shorting to shielding braid
Weak reception	1)	tuning belts loose
	2)	tuning condensers not synchronized

ATWATER KENT 44, 45

Same Case Histories as those listed for Atwater Kent 40

ATWATER KENT 46, 47

Same Case Histories as those listed for Atwater Kent 40, 43

ATWATER KENT 51 D.C.

Same Case Histories as those listed for Atwater Kent 41

ATWATER KENT 52

Same Case Histories as those listed for Atwater Kent 40

ATWATER KENT 53

Same Case Histories as those listed for Atwater Kent 43

ATWATER KENT 54

Same Case Histories as those listed for Atwater Kent 40

ATWATER KENT 55, 55-C

See also Case Histories for Atwater Kent 67

Inoperative	1)	check screen voltage. If zero or below normal, check screen-grid by-pass condenser for short
	2)	if all receiver voltages check O.K., check speaker voice coil for open circuit. Check leads to voice coil for high-resistance joints
	3)	"open" first or second a-f bias resistor
	4)	check detector coupling resistor. Replace with 25,000 ohm resistor (value not critical)
	5)	"open" volume control resistor
	6)	"open" connection to slider of volume control
	7)	"open" bleeder resistor
Weak, distorted, choked reception	1)	"open" detector biasing resistor connected between the detector cathode and ground. Value is 50,000 ohms—use a metalized type replacement unit
	2)	screen by-pass condenser "open"
	3)	if grid-bias on output tube is *high* (or *low*), check two 9,500-ohm bias resistors across speaker field for open-circuit (or short-circuit)
	4)	second a-f bias resistor "open"
	5)	first r-f transformer primary "open"
	6)	receiver tuning circuits need aligning
	7)	if distortion occurs at low volume, replace the 750-ohm resistor biasing the 45's (it is yellow-white and located on top of the wire-wound resistor). Also replace both '27 tube biasing resistors. (for A.K. model 55 only)
	8)	examine joints in leads to voice coil for high-resistance. These joints are halfway between rim and apex of cone
Intermittent operation after being turned on a few minutes—reception gradually fading out completely with a buzzing sound	1)	"open" secondary in second r-f transformer. Test for an intermittently open-circuiting coil while holding a lighted 60-watt bulb near it to heat it. This will hasten the opening if this condition exists
Intermittent operation, Fading, Intermittent noise	1)	"open" secondary of output transformer, or speaker. Disconnect voice coil while making test. Voice-coil leads "opening" intermittently
	2)	loose rivets on wire-wound resistors, especially bleeder No. 1 and the r-f and 1st a-f bias resistors. Squeeze rivets with pliers
	3)	poor connections at ends of various metallized-type resistors. Tug at resistors while ohmmeter is attached
	4)	poor connections at various tubular condensers. Check all joints
Poor high-frequency response	1)	remove the "tone-quality" condenser connected across the plates of the type '45 tubes, located in the audio transformer assembly. (The condenser is located at the top of the can, which must be heated in order to remove it)
Tone poor	1)	change in resistance in either of the two power tube bias resistors shunting the speaker field

(Cont'd)

ATWATER KENT 55, 55-C—(*Cont'd*)

Distortion (accompanied by incorrect grid bias on power tubes)	1)	change in resistance (or "open"), in either of the two power tube bias resistors shunting the speaker field. Resistor connected from bias tap to ground is most frequent offender. Value of this resistor was 10,000 ohms on early production runs—65,000 ohms in the later runs
Distortion at low volume	1)	replace both '27 tube bias resistors (for A.K. model 55 only)
	2)	replace the 750-ohm resistor which biases the '45 tubes. (It is *yellow-white* and is on top of wire-wound resistor)
Audio "howl"	1)	open-circuited 4-mfd. plate filter condenser in the a-f circuit (*C14*). Replace with a new unit
Squealing, or whistling	1)	screen by-pass condenser "open"
	2)	tuning condensers not properly aligned
"Put-put" (motorboating) sound	1)	check all parts in detector and a-f stages, also all condensers. If they all check O.K., make a careful resistance check on all r-f chokes. A "short" of as little as a few ohms in one of them will cause this trouble
Noisy reception	1)	dirty tube socket contacts
	2)	defective "local-distance" switch
	3)	defective type '80 rectifier tube. Replace with new tube
	4)	see "Noisy Reception" for Atwater Kent 41 receiver
Fading	1)	change in value of power tube C-bias resistor across the speaker field
	2)	loose rivets on wire-wound resistors in bleeder, r-f and a-f bias circuits
Fading (accompanied by crackling noise)	1)	faulty carbon resistor. Replace the 50,000-ohm *black* detector coupling resistor; the 7,500-ohm *yellow* second a-f bias resistor; also the other 10,000-ohm *maroon* second a-f bias resistor. Use 1-watt units
Aligning condensers	1)	when the pulleys are completely disconnected from the shaft and the condensers are aligned, replacement of the pulleys usually throws the condensers out of alignment again. To overcome this, loosen one screw completely; then loosen the other very slightly—just enough to allow the condenser shaft to turn when the pulley is held in place

ATWATER KENT 55-F, 55-FC

See also Case Histories listed for Atwater Kent 67

Choked reception, Distortion	1)	detector cathode-bias resistor "open"
	2)	screen by-pass condenser "open"
Squealing, or whistling	1)	screen by-pass condenser "open"
	2)	tuning condensers not synchronized
Weak or no signals	1)	detector coupling resistor "open"

ATWATER KENT 56, 57

Weak, Distorted	1)	no detector plate voltage. Check the resistor located under the cable template in the power pack. This resistor connects the two lugs on the end of the template where the cable joins it
Inoperative, Choked reception	1)	open grid resistor (located on the stators of the variable condensers). Replace with any type resistor around 800 ohms

ATWATER KENT 60, 60-C

See also Case Histories for Atwater Kent 55 and 67 receivers

Inoperative	1)	1050-ohm flat wire-wound resistor under red and yellow resistor mounting "open". Replace with 1-watt carbon resistor
Inoperative (no screen voltage)	1)	"open" connection to volume control slider
	2)	"open" volume control resistor
	3)	"open" bleeder resistor
Weak or no signals	1)	1st or 2nd a-f tube bias resistors "open"
	2)	"open" primary in first r-f transformer
Intermittent operation, Fading, Intermittent noise	1)	see all troubles and remedies listed for Intermittent Operation & Fading for Atwater Kent 55, 55-C receivers
Intermittent reception, (snapping the power switch off and on brings set back to normal)	1)	speaker voice coil "open." Repair or resolder the open circuit
Noisy reception, Low volume, Low plate voltage	1)	drop in value of 40,000-ohm and 65,000-ohm a-f grid resistors. Replace with new units
Noisy reception	1)	see "Noisy reception" for Atwater Kent 40 receiver
Distortion at low volume	1)	replace both '27 tube bias resistors and the yellow-white 750-ohm resistor biasing the '45 tubes. The latter is located on top of the wire-wound resistor
"Put-put" (motorboating sound)	1)	check all parts in detector and a-f stages, also all condensers. If they all check O.K., make a careful resistance check on all r-f chokes. A "short" of as little as a few ohms in one of them will cause this trouble
Aligning condensers	1)	see Case History note pertaining to this subject in Atwater Kent 55, 55-C listing

ATWATER KENT 61-D.C.

See also Case Histories listed for Atwater Kent 67

Inoperative (no r-f plate voltage)	1)	"open" primary in second or third r-f transformer
Inoperative, Choked reception (no grid voltage)	1)	"open" secondary of one of the r-f transformers
Inoperative (no screen voltage)	1)	"open" volume control
	2)	"open" No. 1 screen grid resistor
Noisy (after several thousand hours of use)	1)	overheating of three filament resistors wound on iron strips, causing their insulation to burn and shorting to the iron. Replace. (If the center strip burns out, the first two 22 type tubes will not light)

ATWATER KENT 67, 67C

Fading, Intermittent reception	1)	poorly soldered connections at leads of tubular condensers. Resolder connections
	2)	poor contact between lugs and resistance wire in wire-wound resistors
	3)	poorly soldered connections to metallized resistors having solder ends. In all of the above cases test the connections with an ohmmeter, moving them mechanically during the test, and keeping the test prods on the *terminals* and *not* on the resistance element

(Cont'd over)

ATWATER KENT 67, 67C—*(Cont'd)*

Volume control unable to cut down strong local stations	1)	check for an "open" in the black wire leading from the volume control to the on-off toggle switch
	2)	try "shorting" the switch. If this cures trouble, open up switch and bend up the contact spring so it makes good contact

ATWATER KENT 70, 72, 74, 75, 76

Squealing, or whistling (at certain spots on dial)	1)	worn dial rubber causes dial gear to pull gang condenser rotors out of alignment. Cut a rubber grommet in two, and place a metal washer on each side. Place on the round pin which is fastened to the large dial gear (placing it between the pointer control arm and the dial gear)
Dial readings off calibration	1)	three control-grid leads in incorrect positions. Rearrange them to run parallel and as far apart as possible

ATWATER KENT 80

Weak and distorted, Inoperative	1)	open-circuited output tube grid choke
No control of volume	1)	high-resistance connection between oscillator tube cathode prong and socket. Clean and tighten the socket prongs
Poor sensitivity	1)	defective type '24 AVC tube. Test by removing tube from socket and noting difference in volume. If the volume increases the tube is defective and requires replacement
Hum, Distortion (not due to condensers or resistors)	1)	replace grid resistor in type '47 tube input circuit
	2)	replace the detector plate coupling condenser
Intermittent reception	1)	high-resistance short-circuits between tube socket holes, caused by solder from tube prongs being rubbed on to tube sockets while twisting tubes on socket when locating correct prong holes. Rub pencil eraser on top of tube sockets to clean away any solder and thus remove shorts
Intermittent whistle near 700 kc.	1)	replace resistor from grid of '27 oscillator tube to ground with one of 50,000-ohms
Noisy volume control	1)	raise the end of the contact with long-nose pliers and bend it in toward the winding *slightly*. Then clean the resistance strip with alcohol

ATWATER KENT 82

See also Case Histories listed for Atwater Kent 80

Squealing, or whistling (steady)	1)	replace AVC plate by-pass condenser with new ¼- or ½-mfd. unit
Squealing, or whistling (signals cut in and out)	1)	locate the i-f stage plate trimmer condenser. (This is one of two trimmers located on top of the i-f transformer, completely enclosed in shield con.) Check the mica of this condenser for carbonization or deterioration, resulting in electrical leakage
Intermittent reception	1)	check screen by-pass cond. Replace if necessary
Motorboating (when volume control is set at low-volume position)	1)	0.25-mfd. detector plate filter condenser "open" (connected from detector plate to ground)

(Cont'd)

ATWATER KENT 82—*(Cont'd)*

Tone poor low volume, poor response when tone control is set at "bass" position	1)	r-f choke in the pentode control-grid circuit "open." (It connects to one of the leads going to the tone control switch). A permanent repair may be effected by "shorting out" this choke, as apparently it has no important function in the circuit. This trouble may not be revealed by a set analyzer
Noise when chassis is tapped	1)	coil shield over i-f transf. loose. Tighten all shields
Replacing volume control	1)	be careful when replacing the volume control to leave in the circuit the bleeder resistor from the volume control to ground, and one from the other end of the volume control to the screen-grid terminal of the AVC tube. As these are concealed in the leads connecting these points, they will be left out of the circuit if the leads are changed

ATWATER KENT 82F

Replacing volume control	1)	see the Case History data listed for this under Atwater Kent 82

ATWATER KENT 83

Intermittent whistle near 700 kc.	1)	replace resistor from grid of '27 oscillater tube to ground with one of 50,000 ohms
Poor tone, low volume, poor response when tone control is set at "bass" position	1)	r-f choke in the pentode control-grid circuit "open". (It connects to one of the leads to the tone control switch.) A permanent repair may be effected by shorting out this choke as apparently it has no important function in the circuit. This trouble may not be revealed by a set analyzer
Aligning data	1)	as the alignment trimmers are located inside the coil shields, and the alignment should not be carried on with the coil shields off, either drill holes in the shields to give access for the aligning tool—or use duplicate shields with appropriate holes drilled in the top to permit adjustment

ATWATER KENT 84 (EARLY MODEL)

Inoperative	1)	open-circuited type '24A first detector plate choke due to corrosion at the terminals. Resolder leads at terminals
	2)	internally open-circuited plate coupling and i-f selecting choke in the grid lead of the type '24A i-f tube (value 66-ohms). Replace with a new unit
	3)	"open" 130-ohm antenna choke
	4)	increase in value of 40,000-ohm bias resistor in the oscillator circuit. Replace with new unit
	5)	often necessary to replace 78-ohm i-f transformer primary
	6)	re-align receiver after these changes
Noisy reception	1)	corroded tuning condenser contacts
Noisy reception, Intermittent reception, Fading	1)	intermittently open-circuiting primary winding in one of the i-f transformers. Replace with new unit and realign the receiver circuits
Sustained audio note when set is tuned to high-frequency end of dial	1)	carbon resistors have altered in value. Most likely offenders are: the 0.1-meg. '24A second detector screen grid resistor; the 20,000-ohm '24A second det. cathode resistor; and the 40,000-ohm oscillator grid leak. Replace all three resistors

ATWATER KENT 84, 84F

Inoperative	1)	defective oscillator coil. Replace with new oscillator coil, realigning oscillator at 1500 kc, by means of the trimmer on top of the oscillator tuning condenser. Then adjust the oscillator for 800 kc by means of disc at bottom of coil
	2)	oscill. plate-tuning cond. (at right of chassis, looking from front) "shorted"
Weak reception on strong local stations, (voltages and currents test O.K.)	1)	excess wax from field coil melting and working into the air-grap and voice coil section, freezing the latter
Poor volume, or Intermittent normal volume (voltages normal)	1)	open-circuit in i-f de-coupling choke, due to broken leads at lugs under the protective wax
Intermittent whistling near 700 kc.	1)	replace resistor from grid of '27 oscillator tube to "ground" with one of 50,000 ohms
"Put-put" (motorboating) sound	1)	check second detector bias and screen resistors. Replace if necessary

ATWATER KENT 84 D.C.

Low volume, (voltages test O.K.)	1)	open-circuited connection at lug of choke connected between the i-f blocking condenser and the volume control

ATWATER KENT 85

See also Case Histories listed for Atwater Kent 80 and 83 receivers

Inoperative (operates O.K. when 24A control tube is removed)	1)	replace 30,000-ohm second detector bias resistor connected between second det. cathode and control tube grid on *high* side, and ground on *low* side. Less than 30,000 ohms may be required
Intermittent reception, Noisy reception	1)	poorly soldered connections. Check by wiggling every connection and connecting terminal, as well as wires through shields, etc. with the set in operation
	2)	peeling condenser plates, causing intermittent short-circuits between plates. Burn with high voltage
Poor control of volume (sharp volume cut-off)	1)	defective type '24 AVC tube (even though it may test O.K.)
	2)	"gassy", or high-emission AVC tube
	3)	if there is no plate voltage on '37 detector, replace plate-to-ground by-pass

ATWATER KENT 86

Weak and distorted, Inoperative	1)	output tube grid choke "open"
Poor control of volume	1)	"gassy", or high-emission AVC tube
Tone poor, low volume, poor response when tone control is set at "bass" posion	1)	r-f choke in the pentode control-grid circuit "open." (It connects to one of the leads going to the tone control switch.) A permanent repair may be effected by "shorting out" this choke, as apparently it has no important function in the circuit. This trouble may not be revealed by a set analyzer

ATWATER KENT 89, 89F, 89P

See also Case Histories listed for Atwater Kent 80

Intermittent reception	1)	"open" 800-ohm flexible bleeder resistor connected between screen and cathode of the 24 avc-controlled tube. Resistor may check O.K. with set turned on. Trouble will be revealed if set plays loud when touching hand to chassis and control-grid cap of this tube
Whistling, or squealing	1)	change in value of 425-ohm bleeder resistor. Replace with 1-watt unit
Noisy reception	1)	noisy type '35 variable-mu tube (even though it may test O.K.). Replace with new tube
"Put-put" (motorboating sound around 900 to 1,500 kc on dial)	1)	if all parts in detector and a-f check O.K., check all chokes in r-f system for "open" or "short"
Neon tuning indicator inactive	1)	remove shield from first i-f coil. Scrape away the black sealing compound between the plate and grid i-f coil all the way down to the cardboard tubing on which the coils are wound. This should cure the trouble

ATWATER KENT 91

Inoperative, (high positive grid voltage, 180 volts, on i-f tube) Neon tuning indicator inoperative	1)	see Case History for this same trouble listed under Atwater Kent 96 receiver listing

ATWATER KENT 92, 94

See also Case History listed for Atwater Kent 80

Set dead, but becomes operative after a few minutes, building up to normal reception in about half an hour	1)	short-circuiting trimmer condensers. Clean the trimmers with alcohol and replace the mica strips inside them
Tone poor low volume, poor response when tone control is set at "bass" position	1)	r-f choke in the pentode control-grid circuit "open." (It connects to one of the leads going to the tone control switch.) A permanent repair may be effected by "shorting out" this choke, as apparently it has no important function in the circuit. This trouble may not be revealed by a set analyzer

ATWATER KENT 96

Inoperative, (high positive control-grid bias of 180 volts or more on i-f tubes, neon tuning indicator inoperative or erratic)	1)	small i-f secondary shunt resistor touches i-f coil, permitting it to "short" to the plate winding of the input i-f transformer, causing *positive* plate voltage to be supplied to the grid of the i-f tube. This resistor may be found by removing the i-f coil shield. It is tucked in near the first detector plate coil. Insulate it from the plate winding by wrapping it in cardboard, fibre, or tape and move it away from possible contact with coil winding

(Cont'd over)

ATWATER KENT 96—*(Cont'd)*

Intermittent reception	1)	heater current through the type '35 i-f tubes and type '24 AVC tube too high, causing the AVC tube to draw grid current when heating and resulting in an erratic action of the AVC resistor network. Insert a heavy wire-wound resistor in the heater circuit in order to cut down the heater voltage slightly. This will prevent grid current from flowing in the AVC tube grid circuit

ATWATER KENT 99

Inoperative, (high positive control-grid, bias of 180 volts or more on i-f tubes, neon tuning indicator inoperative or erratic	1)	see Case History for this same trouble listed under Atwater Kent 96
Erratic operation of neon tuning indicator, ("Tonebeam")	1) 2)	defective neon tube. Replace intermittent contact between the end terminals of the 40,000- and the 6,000-ohm resistors which constitute part of "Tonebeam" voltage divider system, resulting in the shorting out of the circuit of the "Tonebeam" potentiometer. This causes a disruption of the biasing arrangement. Provide a better means of insulation between the two resistors
Weak reception	1) 2)	"open" first r-f sec.-return by-pass "open" second r-f secondary by-pass
Intermittent reception	1) 2)	"open" first r-f secondary by-pass "open" second r-f sec.-return by-pass
Fading	1) 2)	leaky first r-f secondary return by-pass condenser leaky second r-f secondary return by-pass condenser
Poor AVC action	1)	replace tube in AVC stage

ATWATER KENT 136

Intermittent, Weak reception	1)	"shorted" 0.1-mfd. tubular condenser (marked *No. 102*) between 6F6 cathode and 0.1-meg. resistor. Replace

ATWATER KENT 145

Audio squeal, (condition is aggravated by touching the grid cap of the type '2A6 tube, but is not affected by touching the grid caps of the '2A7 or '58 tubes)	1)	remove and discard the metal clamp around the type '2A6 tube grid lead at the point where it is grounded. Solder the wire twisted around the grid lead to point where clamp was grounded. (Set analyzer does not reveal this trouble.)
Operation O.K. on short-wave bands but "dead" on broadcast bands	1)	check the 730-mmfd. broadcast band series condenser (long, flat paper-covered condenser riveted to rear wall of the chassis near the 2A7 socket.) An intermittent "open" condition develops. A 700-mmfd. mica condenser may be used for replacement. Re-adjust padder condenser in usual manner for max. output at 600 kc

ATWATER KENT 155

Hum, Distortion	1)	leaky dual and triple filter condensers. Replace with 8-mfd. sections
	2)	change in value of volume control from normal value of ½-megohm. Replace with new unit
	3)	adjust trimmer (between tuning condensers and speaker at the top front of chassis) for loudest volume
Weak, Distortion, Receiver gets out of alignment, Screen-grid resistor changes in value	1)	replace the type '85 tube with a type '75 tube, making the following changes in the circuit: connect a 0.25-megohm resistor in series with the 0.1-megohm resistor and B-plus. By-pass this resistor to ground with a 0.1-mfd., 200-volt condenser. Also connect a 4-mfd., 30-volt condenser across the 300-ohm resistor connected between the chassis and the a-c—d-c switch
	2)	small 0.5-megohm metalized grid-return resistor for the '42 tube needs replacement. It is located at the grid terminal on the '42 tube socket

ATWATER KENT 165

See also Case History listed for Atwater Kent 185 receiver.

Whistling, or squealing (accompanied by hum, distortion)	1)	capacity of 8-mfd. second electrolytic filter condenser has decreased
	2)	install a filter consisting of a 3,000-ohm resistor and 0.2-mfd. condenser (or larger) in series with the B+ lead of the i-f transformer which is in the plate circuit of the 58 i-f amplifier tube
Whistling, or squealing (accompanied by weak reception and cross-talk)	1)	wire-wound pigtail type bias resistor for '57 first detector-oscillator tube "open"
Slipping tuning drive	1)	install new bearing race
Vibrating noise at loud volume	1)	end play in variable tuning condensers
Noisy, when tone control is operated	1)	weak contact spring in the tone control. Put washer under control arm—or replace unit

ATWATER KENT 184

Inoperative, low voltage	1)	check padder condenser between '6C6 tube (second detector) and i-f coil for short circuit (red or brown wire)

ATWATER KENT 185

Whistling, or squealing (when volume is turned on full)	1)	replace the double 250-mmfd. condenser which connects from the plate of the 58 i-f tube to the two diode plates of the 2A6. Use two single bakelite units for replacement

ATWATER KENT 188

"Rattling" at the least vibration, Noisy reception	1)	replace all the control-grid wires to the r-f tubes. The mineral content sometimes present in the rubber insulation may make it conductive, causing interaction. This defect does not usually show up under ordinary tests
Poor tone (usually worse at low-volume levels than at high-volume levels)	1)	volume control resistance has probably increased from normal value of 500,000 ohms up to as much as 1,000,000 ohms. If it has increased to more than 550,000 ohms, replace it

ATWATER KENT 188 (late type)

Weak reception (plate voltage of 55 second det. and 57 silencing tube low)	1)	if resistance of 100,000-ohm *blue and red* metalized resistor from which these tubes obtain their plate supply, has increased to several times this value, replace it

ATWATER KENT 206

Dial calibration at low-frequency end of broadcast band incorrect	1)	adjust broadcast-band oscillator padding condenser. This is the screw at rear of chassis (looks like a mounting screw set back slightly through an opening in the rear wall of the chassis)
Noisy reception, No short-wave reception	1) 2)	increase tension of wave-band switch contacts clean switch contacts with "Carbona"
Whistling, or squealing around 19 to 20 meters	1)	move lead to 2A7 control grid toward front of receiver

ATWATER KENT 217-D

Same Case Histories as those listed for Atwater Kent 7-D

ATWATER KENT 237Q

Intermittent operation (affected by snapping power switch and short-wave switch on and off)	1)	poor contact in the first-detector—oscillator circuit. Check all resistors in the plate, oscillator-plate and screen-grid circuits. Their values are 2,500, 5,000 and 10,000 ohms respectively. Also check the by-pass condensers for these circuits—by substitution

ATWATER KENT 246

Audio howl as volume control is advanced with tone control in "low" position	1)	defective 500,000-ohm volume control. Replace with new unit
Intermittent reception	1)	poor connection at filter choke from plate of type '58 first detector tube, caused by loosening and corrosion of the brads that hold the connection on both sides of the coil

ATWATER KENT 260

Set requires about 2 or 3 hours after the switch is turned on, before it begins to operate. This is only the case in cold weather or when the set has not been used for some time	1)	it is necessary to cool the chassis (possibly by placing it in a refrigerator), then test the individual components when cold. Since the a-f transformer is sealed in a can with pitch, the pitch contracts when cooled, pressing against the windings and possibly causing a short-circuit between two poorly insulated points. When the pitch is heated, it will expand, releasing the pressure and eliminating the short-circuit
Poor tone (usually worse at low-volume levels than at high-volume levels)	1)	volume control resistance has probably increased appreciably from 500,000-ohm normal value. If it has increased to more than 550,000 ohms, replace it

ATWATER KENT 275

Inoperative	1)	speaker field "shorted" due to internal short in negative connections in triple electrolytic condenser *C-14*. If receiver voltages are below normal, check condenser for open sections
Hum	1)	receiver does not use the chassis as a ground return, consequently stray currents in shield and chassis are carried around to all parts of circuit, causing hum. Connect a short lead from the common ground point to chassis, being sure to make good contacts

ATWATER KENT 277

Weak, distorted, reception, Squealing, Whistling	1)	if first-detector cathode bias is high, check 550-ohm cathode bias resistor (long, flexible unit connected to chassis from an insulated terminal on small r-f choke located near oscill. tube socket) for "open"
	2)	check 0.1-mfd. condenser by-passing this unit (for leakage). Replace
Cross-talk	1)	use *red* antenna lead of receiver, and ground the *blue* antenna lead to chassis

ATWATER KENT 310

Inoperative, no r-f or i-f plate voltage (low output plate voltages)	1)	small AVC and second detector coupling condensers shorting to primary of second i-f transformer
Inoperative, (all voltages test O.K., plates of '80 rectifier tube heat excessively) Shadowgraph operates	1)	open-circuited r-f choke in diode circuit (open circuit due to pigtails of the choke)
Inoperative, (no plate voltages) Thin line on shadowgraph	1)	filter choke "grounding" to core or shield. Insulate choke from chassis with a strip of insulating material and mark it "hot"
Inoperative (screen element of one 2A5 tube glowing red hot)	1)	"open" primary section in output transformer located on dynamic speaker
"Sizzling" when receiver is switched on	1) 2)	temporary breakdown of electrolytic condensers change type '80 rectifier to direct-heater type tube
Intermittent reception	1)	particles of solder splashed on wave-band switch contacts
Intermittent reception, Inoperative	1)	open-circuiting 0.0014-mfd. oscillator series condenser due to poor internal contact. Replace condenser
Audio howl (due to oscillation)	1)	mismatched type '2A5 tubes in the push-pull audio stage. Replace with matched tubes
Hum at resonance	1)	oscillator tube cath.-htr. short-circuit
Noise-suppressor control ineffective when tuning dial is being operated	1)	faulty noise-suppressor variable resistor in cathode circuit of 58 i-f amplifier. Replace

ATWATER KENT 317

Inoperative on broadcast band (short-wave reception O.K.)	1)	check the plate voltage on the oscillator section of '6A8 tube. It should be approx. 185 volts. If lower, replace the gray 30,000-ohm, ½-watt plate voltage-dropping resistor. This is connected from the oscill. plate coil to the rectifier filament
Intermittent and weak reception on low-frequency end of dial	1)	check 30,000-ohm plate resistor in oscillator circuit of 6A8. Replace
Whistling (while tuning for foreign stations on short-wave bands)	1)	disconnect the "bucking" or "neutralizing" coil in the 2nd i-f transformer. Unsolder yellow and white leads from the transformer and connect them directly together, leaving the neutralizing coil out of the circuit

ATWATER KENT 318

Intermittent, or no reception, at low-frequency portion of broadcast band	1)	poorly soldered connections to either the top terminal lug of the broadcast band oscillator coil (to which the blue lead from a tap on the third section of the waveband switch is connected), or to the terminal lug next to the unused lug on the coil. This coil may be recognized by its one unused lug terminal
	2)	oscillator coil section "open-circuits"
	3)	corroded or dirty contacts on the oscillator section of the waveband switch. Clean contacts carefully
Weak reception, Distortion (high pitched), Shadowgraph indication narrows, No cathode voltage on '55 tube socket when bottom chassis-shielding cover is in place	1)	cathode terminal of '55 tube socket grounds to one of the self-tapping screws which hold the bottom chassis-shielding cover. Shorten this screw, or bend cathode terminal down to give more clearance
First and *third*, or the *second*, short-wave bands inoperative (except for a "hiss" or "rushing" noise at the low-frequency ends of these bands)	1)	check the connections to the two coils located between the r-f type '58 sockets and the type '2A7 socket. The short leads between the lugs on these coils break, either at the coil or the grounding lug. Check continuity between the "control-grid" of the type '2A7 tube and chassis
Intermittent reception	1)	poorly soldered connections. Pull on all leads while receiver is operating
Fading, Volume changes abruptly	1)	push, and pull, on the volume control shaft to ascertain its condition. Replace the volume control if necessary
Fading, (oscillator drift on short-wave bands)	1)	clean all contacts of waveband switch, being careful not to disturb positions of the wires to the waveband switch
	2)	bond frame of waveband switch to chassis with short lengths of bonding braid
	3)	disassemble and clean oscillator trimmers with alcohol

ATWATER KENT 328

Noisy reception	1)	clean volume control. Check action for noise
Distortion	1)	check grid bias on the '6F5 tube. It should be from 1½ to 2 V. A higher value produces distortion and is usually due to an increase in value of the 22-ohm bias resistor connected from ground to the center-tap of the high-voltage secondary
Intermittent squealing or whistling accompanied by slight noise	1)	clean contacts on "fidelity" switch

ATWATER KENT 337

Same Case Histories as those listed for Atwater Kent 317

ATWATER KENT 345

Intermittent reception, Cuts off completely	1)	defective '2A7 detector-oscillator tube. Replace with new tube

ATWATER KENT 376

Same Case Histories as those listed for Atwater Kent 206

ATWATER KENT 414, 416

Inoperative or weak, Intermittent reception	1)	replace the shorted 0.1-mfd. tubular condenser (marked No. 102) between the cathode of the '6F6 tube and the 0.1-meg. '6Q7 plate resistor

ATWATER KENT 424

Weak reception	1)	check alignment of tuned stages
	2)	broken shielded lead from antenna
	3)	"open" or partly "shorted" buffer condenser in synchronous vibrator. Replace

ATWATER KENT 425

Same Case Histories as those listed for Atwater Kent 165

ATWATER KENT 427, 427-D

Same Case Histories as listed for Atwater Kent 7-D and 277

ATWATER KENT 435

Inoperative, Constant hum	1)	"open" 0.05-mfd. by-pass condenser *C5* in the grid circuit of the 6K7 i-f tube
Whistling (tunable)	1)	replace the oscillator grid coupling condenser. Move 0.03-mfd. tracking condenser to opposite side of oscill. coil
Intermittent noise	1)	replace 20,000-ohm 2-watt carbon resistor supplying screens of the 6A7 and 6K7 tubes

ATWATER KENT 446

Same Case Histories as those listed for Atwater Kent 416

ATWATER KENT 447

Same Case Histories as those listed for Atwater Kent 318

ATWATER KENT 448

Poor tone (usually worse at low-volume levels than at high-volume levels)	1)	volume-control resistance has probably increased appreciably from 500,000-ohm normal value. If it has increased to more than 550,000 ohms, replace it

ATWATER KENT 465Q

See also all Case Histories listed for Atwater Kent 665Q

Distortion, (sounds like defective speaker), "Howling"	1)	open-circuited 8-mfd. electrolytic condenser connected between B-plus at speaker cord and ground. Replace with new unit

ATWATER KENT 469

Distortion, Weak, or fading-out on low-frequency end of dial	1)	use a 0.001-mfd. padder and a small trimmer to replace the 0.00145-mfd. fixed padder condenser located under the oscillator coil. Tune it as you would the regular low-frequency trimmer (i-f is 130 kc)
Poor tone (especially at low volume)	1)	replace volume control if it has increased to over 550,000 ohms

ATWATER KENT 480

Inoperative on low-freq. end of dial	1)	"leaky" by-pass condenser in '58 r-f tube plate circuit
Inoperative, Weak reception (operates if left front "control" tube is removed)	1)	remove 1,500-ohm control tube bias resistor connected to *low* side of tone beam adjustment. Connect a 250,000-ohm unit between *high* side of this adjustment circuit and ground

ATWATER KENT 489

Poor tone (especially at low volume)	1)	replace volume control if it has increased to over 550,000 ohms

ATWATER KENT 509

Hum	1)	try substituting several '56 type tubes in the set until hum disappears

ATWATER KENT 510

See also all Case Histories listed for Atwater Kent 310

Howling (due to audio oscillation)	1)	mismatched type '2A5 tubes in the push-pull audio stage. Install matched tubes

ATWATER KENT 511-W TUN-O-MATIC

Inoperative	1)	inspect leads soldered to *tone-control* switch. Make sure they do not touch and "ground" to *volume control* housing
	2)	make sure that rubber insulated pieces on tone-control leads are back in place
Hum	1)	first try reversing the *antenna* and *ground* connections if hum appears
	2)	try replacing the 5Z3 and 2A3 tubes, as they are critical to hum
Automatic tuning feature does not shut off	1)	check 9-point normal, off and automatic switch at the right of the front panel. If the switching blades are too wide and sometimes contact two points at once (preventing proper opening of the circuit) file the blades down a bit narrower, or replace with the later type switch available from the factory

ATWATER KENT 525

Whistling, or squealing when volume control is turned on full	1)	replace the double 250-mmfd. condenser which connects from the plate of the 58 i-f tube to the two diode plates of the 2A6. Use two single bakelite units for replacement

ATWATER KENT 534

Whistling, or squealing	1)	adjust twisted lead around grid of 75 tube for better control of feedback in this stage
	2)	if this is not effective, first realign the receiver (align i-f at 450 kc); then readjust twisted "feedback" lead

ATWATER KENT 545

Stations shift on dial over short period of time	1)	if stations shift on dial and then shift back to their right numbers in a few days, replace the leaky 0.00036-mfd. condenser *C3* in the first detector-oscillator 6A7 circuit

ATWATER KENT 555

Distortion	1)	faulty 4-mfd. a-f plate circuit filter condenser

ATWATER KENT 557

Same Case Histories as those listed for Atwater Kent 318

ATWATER KENT 559

"Put-put" (motorboating) sound and distortion (as volume is increased)	1)	replace output filter condenser
	2)	check emission of both 2A5 tubes for matching

ATWATER KENT 612

Line fuses "blow"	1)	short-circuited buffer condensers
	2)	inoperative type '83 rectifier tube (not burnt-out)
Noisy, intermittent reception	1)	loose connection to oscillator series condenser
	2)	loose element in type '57 tube
Noisy reception	1)	open-circuited or leaky buffer condensers
Distortion on low volume (clear on high volume)	1)	volume control "open"
Sensitivity excessive	1)	substitute an '80 tube for the '83 feeding the r-f stages. This will not affect local station reception
Silent tuning control irregular in action	1)	this tube plays a very important part in the correct operation of the receiver and must be a perfect tube. When trouble is experienced with the receiver, check this tube first—possibly by substitution

ATWATER KENT 627

Squealing, or whistling, Erratic operation	1)	open-circuited first detector cathode by-pass condenser
	2)	add small 85-mh. r-f choke in cathode circuit of r-f stage
No signals on low-frequency part of dial, Whistling, or squealing	1)	loose rivets on 0.1450-mfd. condenser located in oscillator can. Use a special lead "grounded" to the mounting of this condenser

ATWATER KENT 637

Inoperative on "broadcast band." ("Short-wave" band O.K.)	1)	plate voltage on oscillator section of '6A8 tube should be 185 volts. If this voltage is low, replace the gray 30,000-ohm plate-dropping resistor that has increased in value

ATWATER KENT 649

Inoperative on middle and high-frequency end of dial — 1) check 0.03-mfd. by-pass condenser in oscillator circuit of 6A8 tube

ATWATER KENT 665

See also all Case Histories listed for Atwater Kent 165

Whistling, or squealing — 1) make sure that the screen grid stage control lead spring (which serves as a shield) is kept away from the 2A5 tube

ATWATER KENT 665Q

Fading about 15 minutes after set is switched on — 1) disconnect the red positive wire from the air-cell battery and short-circuit the resistor, making it possible to use the cell for several weeks more

Poor tone — 1) open-circuited connection on speaker coil. The coil is replaceable on early models, but on later models, the entire unit requires replacement

Noisy reception at low volume — 1) defective black electrolytic condenser. Replace with new unit

ATWATER KENT 667

See also the Case Histories listed for Atwater Kent 7-D and 277 receivers

Cross-talk, Weak reception, Whistling, Squealing — 1) "open" or "leaky" by-pass condenser (or an open circuit) in the 1st detector cathode bias resistor
2) if necessary to eliminate cross-talk, ground-bias the antenna circuit (*red* lead)

Over-accentuated bass reproduction — 1) tone may be improved by replacing 0.02-mfd. condenser *C12* on the 2A5 to 0.006 or 0.01 mfd.

ATWATER KENT 667-D

See also the Case Histories listed for Atwater Kent 7-D and 277 receivers

Weak reception, Squealing — 1) "leaky" condenser *C-18*. Replace with 8-mfd. 600-volt unit
2) "open" i-f transformer *T5*. Replace

ATWATER KENT 708, 711

Inoperative, Noisy reception on short-wave band — 1) defective tubes
2) defective silencing adjustment resistor
3) faulty wave-change switch. Resolder all connections here. Realign receiver

ATWATER KENT 808

Broad tuning, Frequency shifting, Poor tone — 1) trouble in AVC circuit. Check the cathode voltage on the r-f 58 and 1'st i-f 58 tubes (with no signal tuned in). A reading of 110 volts should be obtained from cathode to ground on each tube. Now check the cathode voltage while tuning receiver to a station. The reading should now *increase* as resonance is approached. If it does not increase, check the 0.05-mfd. r-f and 1'st i-f grid filters in the secondary returns of these stages for a "shorted" or "leaky" condition. Also check the 2-meg. load resistor in the AVC circuit

ATWATER KENT 810

Audio howl, "Put-put" (motorboating) sound — 1) "open" 10-mfd. electrolytic condensers. Replace with 10-mfd., 200-v. unit
2) check 1,000-ohm carbon resistors connected from 6F6 tube plates through 0.01-mfd. condenser to ground. If heating has made them change value, replace with 1,000-ohm, 1-watt units

ATWATER KENT 812

See also all Case Histories listed for Atwater Kent 612

Poor tone, Blocks at maximum volume setting — 1) value of ½-megohm potentiometer connected to diode plate *2* of the second detector has changed to about 1-megohm. Shunt with fixed 1-megohm resistor to restore potentiometer value to normal

Double-spot tuning — 1) set double-spot tuning trimmer (fourth on 5-gang tuning unit) for minimum signal with test oscillator operating at 1400 kc and receiver dial set at 1240

Noisy reception, Intermittent reception — 1) loose connection inside the sleeving of the wires connecting one end of 1,450-mmfd. condenser inside oscillator coil shield

Erratic operation of silent tuning control — 1) loose element in one of the type '57 tubes in the silent tuning control stage. Replace with new tube

Erratic "tone-beam" operation — 1) intermittent shorting of 46,000- and 40,000-ohm carbon resistors in this circuit. Insulate from each other

No "tone-beam" action — 1) open-circuited 40,000-ohm "tone beam" bleeder resistor

ATWATER KENT 825

Hum when volume control is advanced — 1) leakage between case and one or more sections of filter block. Replace with 3-section 8-mfd. unit

ATWATER KENT 856

See also Case Histories listed for Atwater Kent 317

Double-peak tuning — 1) check the AVC circuit for high-resistance to ground

ATWATER KENT 944

Weak reception, Sensitivity control adjustment has no effect on signals — 1) "open" 1-megohm resistor connected from the 4-mfd. filter condenser to the grid of a '57 tube

ATWATER KENT 976

Same Case Histories as those listed for Atwater Kent 317

ATWATER KENT 1935 Auto Radio

Inoperative (no voltages) — 1) faulty '6Y5G tube
2) faulty condenser across plates of rectifier tube

AUDIOLA

AUDIOLA JR. (WESTMINSTER)

Inoperative — 1) check all the resistors in this direct-coupled receiver as they cause frequent trouble

Inoperative (no plate voltage) — 1) 0.01-mfd. condenser between plate of '45 tube and "ground" "shorting"

Weak, Distortion — 1) 400-ohm bleeder resistor between detector screen and ground "open". Also check all resistors in receiver, and replace any which show large change in value
2) to increase volume, replace the 50,000-ohm resistor section in series with the screen-grid lead with a 35,000-ohm resistor, so as to raise the screen potential

(Cont'd)

AUDIOLA JR. (WESTMINSTER)—(*Cont'd*)

Fading (reception restored to normal when the chassis is tapped)	1)	poorly soldered connections at all three grid cap clips. Resolder these connections
Whistling, or squealing	1)	high-resistance ground connection due to a loose rivet between the dual 0.1-mfd. metal case condenser and the chassis. (This rivet also holds one side of the second r-f tube socket.) Solder a pigtail from the condenser can to chassis
	2)	re-balance tuned circuits
	3)	if oscillation is not eliminated by re-balancing, insert a 0.0001-mfd. fixed condenser between the detector plate and ground and re-balance

AUDIOLA 23-S-10

Tuning indicator inoperative	1)	check 10,000-ohm resistor connected to tuning indicator circuit for change in value
	2)	check 1-mfd. condenser connected to it

AUDIOLA 30-B

No control of volume on powerful local stations	1)	adapt the receiver for use with type '35 tubes. Substitute a 10,000-ohm potentiometer for the old volume control, connecting one end of it to the antenna and the other end to a 25,000-ohm bleeder resistor for the screen voltages; connect also at this latter terminal the original r-f bias resistor. The movable arm of the potentiometer is grounded to chassis. Replace tubes with type '35s
Noisy reception (intermittent, frying noise)	1)	replace push-pull input transformer

AUDIOLA 31

Intermittent fading, Weak at low-frequency end of dial	1)	high-resistance contact between terminal lugs and stator section of gang condenser. Tighten screws, being careful not to throw the stators out of alignment position

AUDIOLA 346 Auto Radio

Weak reception Erratic operation	1)	check wiring of receiver against schematic circuit diagram for errors in factory-wiring
	2)	connect a ¼-megohm ¼-watt blocking resistor, by-passed by a 0.1-mfd. 200-volt condenser to ground, in the r-f grid-return. Also connect a 12,000-ohm ½-watt resistor, by-passed with a 0.1-mfd. 400-volt condenser to ground, in the anode grid-return circuit of the 6A7 tube for the 50,000-ohm resistor

AUDIOLA 7330

Whistling, or squealing	1)	clean the gang tuning condenser rotor wipers of all graphite, etc. When replacing the wipers, make them sufficiently tight for good contact only—friction must not be excessive

AUTOCRAT

AUTOCRAT 80

Weak reception, Hum	1)	leakage between sections of dual electrolytic filter condenser. Replace

AUTOMATIC RADIO MF'G. CO.

(See also listings under AIR MASTER)

AUTOMATIC B

Whistling or squealing (especially when vol. control is set at mid-point)	1)	control-grid lead of 6Q7G tube too close to 25L6G tube

AUTOMATIC C15 Auto Radio

Inoperative (no plate voltages but vibrator operates)	1)	check the leads from the power transformer to the plates of the '84 tube for "breaks". Install new stranded-wire leads for these

AUTOMATIC P40

Inoperative	1)	remove output tube and check the filter condensers for "shorts" (output tube filaments complete the ohmmeter circuit to form an apparent "short")

AUTOMATIC P57

Whistling, or squealing, Inoperative, (usually after playing O.K. for a short time)	1)	connect a 0.25-mfd. by-pass condenser between chassis and screen of the 1N5GT tube
AVC action faulty	1)	resistor in 1A7G grid return lead open, or excessively high value

AUTOMATIC P58

AVC action faulty	1)	resistor in 1A7G grid return lead open, or exceedingly high value

AUTOMATIC JR TS-60

Weak reception	1)	change antenna connection from tap on antenna choke to control grid of 6D6 mixer
	2)	realign r-f stage

AUTOMATIC 741

Hum (after replacing 25L6G tube)	1)	try several of these tubes, as this receiver is critical in this respect

BALKEIT

BALKEIT A3, A5, A7

Noisy reception	1)	faulty audio transformer
	2)	faulty phono-pickup jack
	3)	faulty electrolytic condenser
Fading	1)	worn carbon strip in volume control

BALKEIT 41A

Whistling, or squealing	1)	high-resistance or open-circuiting contacts of loose or improperly fitting tube shields. Solder flexible pigtails between all tube shields and the chassis
	2)	interaction between the wires from the diode plates and control-grid of the type '75 tube. Separate the leads

BALKEIT 100

Inoperative, Interrupted reception	1)	check for "open" choke. Replace, and check condensers *C11* and *C12* for "open" or "short". Replace *C12* with a 4-mfd. 600-volt unit.
	2)	erratic functioning of oscillator. Try new oscillator tube. Check oscillator circuits

BELMONT

BELMONT 41, 42A

Inoperative	1)	short-circuited primary winding in the output transformer. Replace with a new unit

BELMONT 51-C

Inoperative, (no plate voltage on the type '57 detector tube)	1)	defective 250,000-ohm 57 detector plate-supply resistor. Replace with new unit. Inspect rectifier socket and leads for defects also
Noise at high volume, (banging the set will bring this noise out at any level)	1)	broken type '80 tube plate lead terminal between the wafers of the tube socket, resulting in intermittent contact. Replace the socket

BELMONT 71C

"Birdies" heard over entire dial	1)	caused by a-f modulation of oscillator. Grid leak for the 56 tube increased in value. Replace with one of proper resistance value

BELMONT 100

Fading, Noisy	1)	try replacing the volume control (1-megohm unit)

BELMONT 101

Distortion, Two-spot tuning	1)	check leakage of the 0.05-mfd. condenser in avc lead of r-f stage
	2)	check leakage of 0.05-mfd. cathode-to-ground condenser in same stage

BELMONT 415

Inoperative	1)	*"A"* or *"B"* batteries discharged
	2)	4-amp. fuse in *A*-battery line blown
	3)	tubes make poor contact with sockets, or grid clips make poor contact with the caps of the tubes
Weak	1)	*"A"* or *"B"* batteries weak
	2)	see trouble (3) under "Inoperative"
Noisy	1)	defective tubes. Check all tubes
	2)	see trouble (3) under "Inoperative"

BELMONT 420

Whistle,	1)	oscillation in type '38 power pentode amplifier tube, due to change in value of control-grid and cathode-grid resistors. Replace with new resistors if values have changed appreciably
	2)	change in value of type '76 r-f amplifier tube plate resistor. Replace with new unit
Does not tune down to 1712 kc	1)	see that green (*grid*) and black (*ground*) wires connected to the antenna coil are well separated from each other. Also keep the green leads to the grid cap and the antenna away from the tube shield

BELMONT 440

Replacing pilot lights	1)	the chassis must be removed from the cabinet to do this. Pilot lights are wired in series—use 6-8 volt 0.15-amp. bulbs

BELMONT 525

Noisy	1)	inspect all carbon resistors and push away any leads which may be resting against them

BELMONT 540 AC-DC

Inoperative on all but strong local stations	1)	check the 25-mfd. condenser *(C13)* connected from the cathode of the 25Z5 tube to choke

BELMONT 550

Reception weakens shortly after receiver is turned on (plate voltage drops from 300 volts to around 90 volts)	1)	check for "shorted" i-f input transformer. See if lugs inside can are "shorting" to windings. Bend lugs away from coil, or cut off their ends

BELMONT 578, 585 (Series A, B, C & D)

Whistling, Distortion	1)	by-pass condensers "open". Replace all defective units
Hum, Motorboating, Low volume	1)	electrolytic filter condenser "shorted" or defective. Replace with new unit
Low volume, Distortion	1)	open- or short-circuited by-pass condenser across type '42 tube bias resistor. Replace with new unit
	2)	electrolytic condenser "shorted"

BELMONT 588

Whistling, Distortion	1)	by-pass condenser "open"
Excessive hum, Low volume, All d-c voltages below normal	1)	electrolytic filter condenser "shorted"

BELMONT 661, 667 Auto Radios

Inoperative, Weak, Noisy	1)	defective tubes
	2)	tubes making poor contact with sockets
	3)	grid clips making poor contact with tube caps
Fuse blows out frequently	1)	if fuse blows out frequently even though the insulating sleeve is in place over it properly, the trouble is probably in the vibrator, and it should be replaced.

BELMONT 670-A

Fuse blows out frequently	1)	defective vibrator unit. Replace with new unit
Inoperative, Noisy reception, Weak reception	1)	defective tubes (even though they may check O.K.) Replace by substitution
Case "buzz", Case rattles	1)	loose screws in top or bottom case covers
	2)	loose tube elements. Replace tubes
	3)	loose tube or r-f coil shield
	4)	loose grille cloth

BELMONT 675

Inoperative	1)	"open" section in bleeder resistor—usually the 13,000-ohm section
Inoperative (tone control at "Bass" position)	1)	0.02-mfd. condenser across output transformer "shorted"
	2)	check 13,000-ohm screen-dropping resistor for "open"
Planetary vernier-dial drive mechanism inoperative	1)	cracked or broken compression ring. Disassemble dial drive by removing the two screws which fasten it to the dial bracket
Excessive hum, Intermittent reception, Low volume	1)	electrolytic condenser "shorted". Replace with new unit
Distortion, Whistling	1)	by-pass condensers "open". Replace all defective units

BELMONT 685, 686, 686A, 686B

Inoperative on broadcast band, O.K. on short waves	1)	try connecting a 0.003-mfd. condenser in parallel with the *C-6* condener (one of the units next to the front of the chassis of the pair connected from the waveband switch of the 600 kc padding condenser)
Dial drive slippage	1)	install new type belt take-up assembly now available from manufacturer for these receivers

BELMONT 740, 741

Same Case Histories as those listed for Belmont 588

BELMONT 750

Failure to operate over both bands	1)	defective type '2A7 tube (even though it may test O.K.) Replace with new tube by substitution
	2)	defective wave-change switch contacts
Slipping dial drive	1)	slide the bronze washer drive assembly either closer or farther away from the variable shaft, in the slot in which it is mounted

BELMONT 770

Hum, (intermittent, appearing after receiver is "on" for some time and disappearing if line switch is snapped "off" and "on")	1)	common lead of the dual 0.1- and 0.25-mfd., 200-volt condenser "opens" at the point of attachment of the lead to the foil of the condenser. Replace the entire condenser unit by two separate units of identical capacity and voltage rating as the components of the original unit. The 0.1-mfd. condenser is a screen bypass for the '6B7 tube; the 0.25-mfd. cond. is a hum filter for the bias voltage of the '42 tube
Frying noise (heard only until tubes warm up)	1)	due to scintillation of the special "regulator" type electrolytic filter ocndensers used in this receiver. Do not replace condensers because of this scintillation noise—it shows normal operation

BELMONT 777

Same Case Histories as listed for Belmont 578 and 770 receiver

BELMONT-GAMBLE 777 Series B-C, 778 Series A

See also Case Histories listed for Belmont 770

Inoperative	1)	oscillator coupling coil "shorted" by terminal of 19,000-ohm resistor (in '76 oscillator tube plate circuit) making direct contact with terminal of 100-ohm resistor in this same plate circuit. Keep these two resistors apart
Improving tone of Model 777B	1)	replace 180-ohm cathode resistor on 6D6 tubes with a 300-ohm unit

BELMONT 778, 778B

See also Case History listed for Belmont 787

Inoperative, Intermittent, Inoperative on low-frequency end of dial around 1200 kc	1)	check 0.0005-mfd. molded condenser across terminals of low-frequency trimmer for "open"

BELMONT 786, 786A

See Case Histories listed for Belmont 685 and 787 receivers

BELMONT 787

Dial drive slippage	1)	install new type belt take-up assembly now available from manufacturer for these receivers. (Note: some Model 787 dial drives are equipped with a wide red belt. In these receivers, this belt will still give trouble even if the newer type belt take-up assembly is installed. It is advisable to replace the belt with a newer two-ply type)

BELMONT 804

Same Case Histories as listed for Belmont 415 receiver

BELMONT 878, 879

Dial drive slippage	1)	install new type belt take-up assembly now available from manufacturer for these receivers

BELMONT 888, 889

Same Case Histories as those listed for Belmont 588 receivers

BELMONT 1170

Same Case Histories as those listed for Belmont 588 and 685 receivers

BELMONT 1170B

See also Case Histories listed for Belmont 588 and 685 receivers

Inoperative (tubes check O.K.)	1)	check the 0.1-mfd. condenser *(Part No. 100.20)* located at the base of the 6F5 tube. (It is connected from the center of the two 100-ohm resistors which are connected in series from the plate of the 6F5 tube to the primary of the input transformer.) Replace with a 0.1-mfd. 600-volt unit

BELMONT 1171, 1172

See also Case Histories listed for Belmont 685 receiver

Pilot lights do not light	1)	2-amp. line-fuse blown (in those chassis equipped with a '5Z4 rectifier tube and a line fuse). First disconnect all power. Then remove fuse cover located on back flange of chassis. Replace blown fuse with a 2-amp. fuse. If replacement fuse also blows out, check all tubes (particularly the '5Z4 rectifier) circuit, repair or replace inoperative tubes or parts

BEST

BEST 4 TUBE MIDGET

Inoperative, (only voltage present across speaker field)	1)	defective type '25Z5 tube, caused by an open-circuit inside one of the cathode leads. Replace with new tube
Difficulty in tuning, Set drifts off frequency setting	1)	loose tension of the springs on the tuning condenser rotors. Solder pigtails across rotors and springs

B.O.P. AUTO RADIO RECEIVERS

B.O.P. "AIR MATE" Auto Radio

Inoperative	1)	substitute a new vibrator
Distortion, Poor tone at high volume	1)	decrease of value of condensers in electrolytic condenser block. Replace the complete section if any unit is defective (never replace single units)

B. O. P. 4036 Auto Radio

Inoperative	1)	changed value of resistor associated with avc network of 85 combined 2nd detector, avc, and a-f amplifier tube
	2)	open push-pull input transformer to a-f amplifier
Inoperative from about 550 to 860 kc	1)	"open" 3,600-ohm cathode bias resistor
	2)	resolder antenna coil connections
Intermittent reception	1)	resolder all joints on antenna coil

B. O. P. 980393

Vibrator "hash"	1)	replace two electrolytic condensers located in speaker case

B.O.P. 980459

Intermittent reception, Low volume, Poor bass response	1)	carefully check condition of primary winding of push-pull input transformer. Voltage analyses may be misleading, as voltages are not likely to be affected

B. O. P.—BUICK Auto Radios

See Case Histories listed under Buick

B. O. P.—CHEVROLET Auto Radios

See Case Histories listed under Chevrolet

B. O. P.—OLDSMOBILE Auto Radios

See Case Histories listed under Oldsmobile

B. O. P.—PONTIAC Auto Radios

See Case Histories listed under Pontiac

BOSCH

BOSCH JR.

Same case histories as those listed for Bosch 16, 17, 18

BOSCH "LITTLE SIX"

See Case Histories listed for Bosch 46 receiver

BOSCH 5A

Inoperative	1)	burned-out 500,000-ohm ½-watt resistor in screen circuit of 24 detector. Replace with 1-watt type
Distortion	1)	if all tubes and parts check O.K. install a 20-ohm center-tap resistor across the 2.5-volt heater winding. Then connect a 100-ohm resistor from center-tap to ground

BOSCH 5-C

Inoperative	1)	open-circuited field coil

BOSCH R6, R7

Poor selectivity	1)	receiver circuits out of alignment. Retrim with only a short length of wire connected to antenna post (no ground) and a signal between 1400 and 1500 kc tuned in (with volume control set at "max"). Now, without moving tuning dial, connect back regular antenna, reduce volume control setting, and retune the first (*ant.*) trimmer. Advise set owner to use a fairly short antenna with the set, as it trims up better on one

BOSCH 10

Fading on weak stations	1)	due to defective '27 AVC tube. To test, tune to a signal, then remove AVC tube. If volume increases, the '27 AVC tube is not operating properly, and should be replaced

BOSCH 16, 17, 18

Inoperative, Extremely weak reception	1)	carefully examine the volume control and tuning gang shafts to make sure they are not "shorted." If they "short" together, signals will be practically inaudible
Noisy tuning, whistling (as tuning dial is rotated)	1)	high-resistance variometer wiping contact. Remove the inner shaft of the variometer and carefully clean the wiper blade and brass contact surface. In assembling the unit, bend the blade so that it will make better contact
	2)	broken pigtail at condenser next to the variometer. Solder a new one about 1½-inches longer
	3)	poor tension of contact springs or rotor of tuning condenser gang. Clean contacts and provide better tension, or solder in pigtails between the rotor and condenser frame
Weak reception at high or low frequencies, Whistling	1)	variometer rotor not working together with condenser gang. When the tuning condenser is at zero setting, the variometer rotor should be at right angles to the stator
Hum	1)	defective tubes
	2)	open-circuited section in center-tapped resistor
	3)	unmatched audio transformer secondary windings
	4)	connect a 2-mfd. filter condenser from one side of the speaker field terminals to chassis, determining exactly which is the best side by trial connections
	5)	choke tuning condenser "shorted"
Weak reception, Poor sensitivity (high plate current in 2nd or 3rd r-f tube)	1)	open-circuited 500-ohm carbon resistor in the control-grid circuit of the second or third-r-f stage
	2)	volume control shaft short-circuiting to metal panel
Noisy reception	1)	leaky 0.001-mfd. detector plate by-pass condenser

BOSCH 20

Whistling or squealing	1)	short-circuited 40,000-ohm, 1-watt oscillator plate-voltage dropping resistor. Replace with a 3- or 5-watt unit
Poor control of volume	1)	remove the antenna lead from the volume control and use the control only on the cathode of the i-f tube. Add a 1,000-ohm minimum bias resistor to the 200-ohm volume control unit in the set at present

BOSCH 28, 29

Inoperative, Extremely weak reception	1)	carefully examine the volume control and tuning gang shafts to make sure they are not "shorted." If they "short" together, signals will be practically inaudible
Inoperative, (all voltages normal)	1)	inspect rubber-covered wire from antenna variometer to volume control for possible "shorting" to chassis where it passes through sharp-edged drilled holes

(Cont'd)

BOSCH 28, 29—*(Cont'd)*

Intermittent reception, Fading	1)	black lead from the variometer stator "shorts" to chassis intermittently. The sharp-edged hole through which the lead passes cuts through its insulation and the vibration causes it to touch the chassis intermittently. Replace with a heavier insulated lead, providing also adequate insulation at the hole. Remove any burrs or sharp edges at the hole
	2)	loose lug on front of first condenser stator section
Weak reception, Distorted reception	1)	open-circuited 50,000-ohm detector plate supply resistor
Noisy reception	1)	noisy 50,000-ohm detector plate supply resistor
	2)	noisy primary windings of a-f transformers
	3)	noisy volume control. Replace with new unit
Whistling, "Put-put" (motorboating) sound	1)	add another condenser (not over 0.002-mfd.) in parallel with the present one used to by-pass the detector plate resistor
	2)	another remedy is to use a lower detector plate resistor—say 20,000 to 40,000-ohms
Hum adjustment	1)	look for 6 adjustment condensers near the tube sockets (being careful not to confuse the hum-neutralizing condensers with those used to trim the tuning condensers)
Hum (very loud)	1)	"shorted" r-f bias resistor. May be caused by a "short" in one of the two condensers in series (with their center connection grounded) which are connected across the '26 tube filament circuit
Hum at resonance	1)	open-circuited supply line by-pass condenser. Out of neutralization
Replacing volume control	1)	use a Centralab replacement unit (*3 72-102*) of 25,000 ohms. Install it at the point of control instead of at the left end of the chassis where the old control is located. Ground metal cover on rear of replacement unit to prevent oscillation. This type of installation makes the control cables and pulleys unnecessary

BOSCH 31, 32

Inoperative, Intermittent reception	1)	if routine tests indicate no plate voltage on tubes, disconnect leads from last i-f transf. Check for prim-sec "short"
Fading, Intermittent reception	1)	faulty 300,000-ohm resistor in the i-f stage. Substitute another of equal value
	2)	intermittently open-circuiting screen voltage-divider resistor
	3)	intermittently open-circuiting second-detector screen resistor
Weak reception, Hum	1)	short-circuited field coil tuning condenser
Hum	1)	open-circuited filter condenser
	2)	short-circuited field coil "by-pass" or "tuning" condenser
Muffled tone Distorted	1)	open-circuited second detector screen resistor
Poor tone at low volume	1)	intermittently open-circuiting 2-megohm screen-grid resistor. Replace

BOSCH 38

Same Case Histories as those listed for Bosch 28, 29 receivers

BOSCH 46 ("Little Six")

Inoperative, Intermittent reception	1)	banging of tuning condenser gang causes trimmer condenser plates located in front of each tuning condenser section to shift and "short" that section of the gang. Clear any such "shorts"
Weak reception, Whistling	1)	"open" 226 tube bias resistor by-pass condenser
Hum at low-frequency end of dial	1)	this receiver requires a very good ground for hum-free operation. Try several available types of grounds

BOSCH 48

See also all Case Histories listed for Bosch 16, 17, 18 receivers

Inoperative (except on strong local signals)	1)	"open" output transformer
Weak reception, Whistling	1)	aerial tuning variometer out of synchronism with tuning condenser gang
Fading, Noisy when tuning	1)	remove aerial tuning variometer from chassis. Remove rotor and clean bronze "wiper" spring for better contact
	2)	clean all "wiper" spring contacts on tuning condenser

BOSCH 48A, 48AA

Noisy tuning, Whistling	1)	poor grounding of the shield on the variometer. Drill two small holes through cap and base (where they overlap) — about 1½ inches apart—and drive in two self-tapping screws after rim contacts have been cleaned thoroughly

BOSCH 49

See Case Histories listed for Bosch 16, 17, 18 and 48 receivers

BOSCH 54 D.C.

See also Case Histories listed for Bosch 16, 17, 18, 48 receivers

Inoperative	1)	"open" wire-wound Edison-base type resistor in filament circuit (one of 3) located in speaker compartment
Distorted Low or no output grid bias	1)	weak or exhausted "C" battery
Weak reception, High plate current on 2nd or 3rd r-f tube	1)	"open" 500-ohm grid suppressor resistor located inside condenser-gang compartment mounted upon compensating condenser brackets
Weak reception, Disorted, Resonance hum	1)	"open" 1-mfd. detector cathode by-pass condenser. Try a 2-mfd. unit here for better tone quality

BOSCH 58

See also Case Histories listed for Bosch 60 receiver

Inoperative (no grid bias on the first a-f tube)	1)	defective 2-megohm coupling resistor in the grid circuit of the first a-f tube. Replace with a new unit
Inoperative, (set operates when control-grid lead of first r-f tube is touched)	1)	test variable condenser across antenna coupling stage for short-circuited plates. The cap screws holding the rotor plates usually work off center and touch stator plates

(Cont'd over)

BOSCH 58—*(Cont'd)*

Inoperative, Noisy operation (with power transformer overheating, and rectifier tubes red hot)	1)	examine rectifier tube socket for evidence of carbonization due to arcing between the terminals. Replace it if necessary
	2)	leads from the transformer to the rectifier plates have poor insulation which permits "shorts" to occur between them if they cross over. Replace these leads with wire having high-grade insulation
Distortion, Weak reception, Station "hiss"	1)	open-circuited detector screen resistor
	2)	open-circuited de-coupling resistor
Lack of sensitivity	1)	adjust antenna aligning condenser, located above antenna and ground posts, at 1,000-kc for maximum volume
Noise, Sudden changes in volume	1)	check both the "on-off" and "local-distance" switches for poor, or intermittent contact
	2)	check connections to local-distance switch for incorrect wiring. Correct connections are: *yellow* to antenna, *black* to unmarked post, *red* to ground
Hum	1)	tighten all bolts in the casing and core of the power transformer to prevent vibration of the laminations

BOSCH 60

See also all Case Histories listed for Bosch 61 receiver

Inoperative	1)	short-circuited 0.25-mfd. r-f plate by-pass condenser located under the tube sockets behind the r-f tuning unit
	2)	check 1,500-ohm resistor between terminals *No. 1* and *No. 3*.
Weak reception, distortion	1)	adjust antenna aligning condenser (located above antenna and ground posts) at 1,000-kc for maximum volume
	2)	poor contact at the phono switch which should cut out the r-f stages when the tuning condenser plates are disengaged
Weak in "local" position, Station "hiss"	1)	open-circuited 500-ohm resistor in local-distance switch circuit
Intermittent reception, Low volume	1)	replace the 1-meg. *black-and-white* resistors in the detector screen circuit with a 2-meg unit. (This resistor is about an inch long)
	2)	"open" 0.04-mfd. first r-f coupling condenser (leakage in this unit will cause *Fading*)
	3)	"open" 0.5-mfd. second r-f secondary-return by-pass condenser (leakage in this unit will cause *Fading*)
Hum	1)	"open" 1-mfd. condensers connected between each side of line and chassis
Little or no ave action	1)	try new 24 avc tube (with receiver turned on but tuned off-resonance). Tube that does not swing resonance indicator needle either way is likely a good one

BOSCH 61

Two-spot tuning, Weak reception, Distorted, choked reception, Poor sensitivity, Erratic tuning meter	1)	open-circuited 1-megohm detector screen resistor. Replace with a 1- or 2-megohm ½-watt unit. (This resistor is not shown on schematic diagrams of the receiver, but is a small *black*-and-*white* carbon unit under the avc tube socket)
Station "hiss," Weak reception	1)	open-circuited r-f de-coupling resistor
	2)	"open" r-f sec. return by-pass cond.
	3)	broken lead to 500-ohm resistor in local-distance switch circuit
	4)	open-circuited 500-ohm resistor in local-distance switch circuit

BOSCH 62 (1933)

Inoperative	1)	inoperative AVC tube
Weak reception	1)	leaky or partially short-circuited AVC plate by-pass condenser

BOSCH 73

Low volume when set is switched on—reception becoming normal about 15 minutes after set is operating	1)	open-circuited third r-f screen-grid resistor. This is a 750-ohm, 1-watt wire-wound unit. Replace with a carbon unit

BOSCH 79C AUTO RADIO

Weak reception	1)	efficiency of r-f and oscillator stages lowered by presence of three or four ohm resistance in the tuning condenser leads and contacts. This may be corrected by tighting the screws that hold the insulating bracket on the stator plates

BOSCH 80

Weak reception, poor tone quality	1)	entire condenser gang out of line. Rotor plates should be adjusted so they are accurately and evenly positioned between the stator plates. Then align the receiver
	2)	loudspeaker needs adjusting. Loosen the two adjustments provided on the speaker and center the armature so as to allow a clearance of about 0.009 inch on each side

BOSCH 96A

Weak reception, Distortion	1)	loose driving rod on the magnetic speaker cone. Solder the rod to the cone

BOSCH 126

Same Case Histories as those listed for Bosch 46 receiver.

BOSCH 140

Inoperative	1)	"shorted" 0.01-mfd. condenser inside of plug-in type vibrator unit. Trouble is indicated by continuity being obtained between two or more of the five prongs at the base (except between those corresponding to the grid and cathode of a '27 tube). Remove the three screws at the base of the vibrator unit. Open the case, and slip off the sponge rubber casing. Replace the 0.01-mfd. condenser with one of the small tubular type
Intermittent reception	1)	defective coupling condenser between '75 tube plate and '41 tube grid. This condenser is in a case with seven others, and can be cut out of the circuit. Replace it with new 0.001- or 0.005-mfd. cond.
Howling (audio feedback)	1)	if the '75 tube grid lead (which is brought up from below) between this tube and the '41 is too close to the '41 tube, audio feedback will occur. Keep this lead as close to the '75 tube as possible by twisting the grid clip—or shield it and "ground" the shield under one of the feet of the i-f can next to it.

BOSCH 146

Same Case Histories as those listed for Bosch 46 receiver

BOSCH 150

Short-wave reception at center of dial setting	1)	i-f amplifier out of alignment (i-f is 175 kc)
	2)	oscillator not tracking properly. Check tracking of oscillator condenser
	3)	loose coil and tube shields. Tighten them securely
Erratic operation over part of dial	1)	loose screws holding the lower side of the oscillator condenser stator plate assembly. Tighten these screws, and realign the receiver
Hum, Pilot light flicker	1)	imperfect contact or connection where one side of filament winding is connected to the chassis by means of a lug on the same rivet that fastens the 2A6 tube socket and shield to the chassis. Resolder this connection

BOSCH 150A Auto Radio

Vibrator "hash"	1)	dress switch leads on rear of volume control away from vibrator wiring

BOSCH 166, 176

Same Case Histories as those listed for Bosch 46

BOSCH 200, 201

Weak reception, Noisy reception	1)	leaky dual 4—8-mfd. electrolytic filter condenser in power pack. Replace
	2)	defective 0.01-mfd. line buffer condenser. Replace with new unit

BOSCH 236

Distortion	1)	replace 250,000-ohm 57 second detector cathode resistor with a 25,000-ohm unit

BOSCH 242, 243

Weak reception, Poor tone	1)	(*a*) remove 0.05-mfd. audio coupling condenser between detector and first audio tubes. (*b*) remove the 1-megohm resistor in the plate circuit of the type '56 detector tube. (*c*) connect together the two open leads which are left as a result of the above—(one is from the volume control, and one is from the '56 plate)

BOSCH 310

Noisy	1)	replace 20,000-ohm oscillator grid resistor

BOSCH 350

See also Case Histories listed for Bosch 352 receiver

Inoperative	1)	filter condensers *C-39* or *C-40* "shorting" from "high" side to ground
	2)	one section of resistor *R3* "open" (values of sections are: 1,000, 12,000, 8,000 and 6,000 ohms)
Intermittent reception, Hum (dial-light bulb flickers) (heater voltages low)	1)	loose rivets holding soldering lugs of grounded sides of filaments at tube sockets. Make sure all these rivets are tight and are making good contact with the chassis, or solder heavy wires from the ground lugs to chassis. The contact of the filament-line "grounding" rivet which holds the '2A6 tube socket and base of tube shield to the chassis is especially important
Hum modulation of signal	1)	faulty contact at "grounding" rivet in common-return of filament supply and various grid returns. This rivet is located at about the middle of the chassis shelf and fastens one of the tube sockets in place
Short-wave interference at middle of dial	1)	check the i-f and the oscillator condenser, making sure that the tube shields and coils are tight

BOSCH 352

Inoperative on No. 1 band	1)	imperfect contacts on wave-band switch. Replace
Whistling	1)	"detune" r-f padder slightly
	2)	clean condenser wiper fingers

BOSCH 360, 360M

Inoperative	1)	filter condensers *C-39* or *C-40* "shorting" from "high" side to ground
	2)	one section of resistor *R3* "open" (values of sections are: 1,000, 12,000, 8,000 and 6,000 ohms)
Intermittent whistling	1)	corroded joints (poor "grounding") between tube shield and shield bases. Drill a hole through the side of each shield and through the base. Put a small "Parker-Talon" self-threading screw in each hole
Steady or intermittent whistling on weak stations	1)	poorly grounded tube shields or corroded contacts between the shields and chassis. Bond shields to chassis with separate pigtails or aluminum solder

BOSCH 370, 370E

Intermittent reception	1)	poor contact in waveband switch. Clean with carbon tetrachloride
Weak reception, Hissing	1)	primary winding in antenna coil "open"
Whistling (weak)	1)	"open" by-pass condenser *C-33* in antenna circuit

BOSCH 402

"Howls" (only while set heats up), Inoperative	1)	faulty type '6F7 tube (even though it may test O.K.). Replace with new tube

BOSCH 440C

Erratic and weak reception after receiver plays a few minutes	1)	lug on low-frequency oscillator padder condenser *C-39* "shorting" it

BOSCH 501

Whistling and squealing	1)	loss in capacity of either (or both) filter condensers. First, try replacing either or both filter condensers. Try shunting a 0.1-mfd. 400-volt paper condenser across the second filter if you find that the foregoing replacement does not eliminate the trouble

BOSCH 502

Whistling on every station	1)	place a shield plate between the 75 and 43 tubes and solder it to the chassis

BOSCH 505

Noisy	1)	install new volume control

BOSCH 536

See Case Histories listed for Bosch 636, 637, etc., Auto-Radio Receivers

BOSCH 595M

Noisy	1)	replace the input transformer with the new type which is sealed in wax

BOSCH 604

Distortion	1)	"leaky" 12-mfd. by-pass condenser in 43 tube cathode circuit

BOSCH 620, 625

Hum	1) check filter condensers for excessive leakage 2) replace the 0.1-mfd. first detector and i-f grid return by-pass condensers with 0.25-mfd. (or larger) units

BOSCH 636, 637, 736A2, 737A2, 738A2-1936 Model Auto-Radio Receivers

Inoperative (vibrator dead, no plate voltages)	1) check the fuse in the container on the lead from the control-head to ammeter
Inoperative (tubes do not light)	1) remove the loudspeaker cover and disconnect the speaker plug. Remove the vibrator and the tubes. Check with an ohmmeter from hot *"A"* side of receiver battery cable to ground. Should this show an open circuit, obviously a tube or the vibrator is shorted and these parts can be checked separately to determine which is faulty. On the other hand, if the ohmmeter shows a closed circuit, the chassis should be removed from the housing and checked for an internal short circuit
Inoperative (tubes light and vibrator buzzes)	1) check the *"B"* voltage (approximately 240 to 250 volts) from the middle terminal of the electrolytic filter condenser to "ground" of the chassis. This point is easily reached with the speaker cover removed. If no voltage or low voltage is observed, test the vibrator and the '0Z4 or '84 rectifier tube. If voltage is still incorrect, the receiver should be removed from the housing and the component parts checked for shorts. The power pack should first be checked alone by disconnecting the receiver load 2) with the speaker plugged in, remove the clip from the grid cap of the '6F5 tube and touch the clip to the grid cap of the '6F5 (in models 536-636-637 this will be the '75 tube) several times in succession. A clicking noise should be heard in the speaker. This is an effective test for the audio amplifier and speaker. If this clicking noise is not heard, the '6F5 and '6F6 tubes in the case of models 736A2, 737A2, 738A2 (and '75 and '42 tubes in models 536, 636, 637) should be tested and the voltage checked at the plates of these tubes. The speaker should be checked with a volt-ohmmeter by testing across the prongs of the speaker plug for continuity. While making this test the cable should be moved back and forth to show up a possible intermittent open circuit in the speaker cable. Check the voice coil and field coil for proper resistance values 3) if the audio and speaker are still dead, the chassis should be removed from the housing 4) if the audio and speaker are working correctly, test the remaining tubes and check the voltage at each socket 5) to remove the chassis from the car for repairs proceed as follows: disconnect all external cables and the flexible shafts from the receiver. Remove the speaker cover and pull out the speaker plug. Remove receiver from the bulkhead and remove chassis from housing by taking out the five mounting screws, four of which are located on the *side* and one on the *bottom* of the housing

(Cont'd)

BOSCH 636, 637, 736A2, 737A2, 738A2 —1936 Model Auto-Radio Receivers—*(Cont'd)*

Locating trouble in the chassis	1) to locate a "short", "open", or defective unit which causes low or no "B" voltage, disconnect the power pack from the receiver section by disconnecting the two red leads (models 736A2, 737A2, 738A2) at each end of the 4,000-ohm resistor in the power pack that pass into the receiver section. Check the voltage at the input side of the resistor, (which should be approximately 250 volts) For models 636, 637, disconnect the two red leads coming from the receiver section from each end of the 5,000-ohm resistor to "ground" (which should be approximately 250 volts) For model 536 disconnect the red lead which goes from the r-f choke coil to the plate resistor of the '75 tube. Check the voltage from the free end of this red lead to "ground" (which should be approximately 250 volts). If these voltages are incorrect, the trouble definitely is in the power pack and all component parts should be thoroughly checked Conversely, if the voltage reading proves to be correct, the trouble is in the receiver section and all parts should be checked. In locating a "short" or "open" in the filament circuit, the power pack can be disconnected from the filament supply of the receiver section by (1) removing red wire in top terminal of "off" and "on" switch (models 535, 636, 637), or (2) removing the red wire from the lower terminal of the r-f battery choke in models 736A2, 737A2, 738A2. This will connect only the power pack in the filament circuit, and if the "short" or "open" is corrected thereby, it will prove that the trouble is in the receiver section.
Intermittent reception	1) usually caused by a poor connection from the set antenna lead to the car antenna lead-in. This joint should always be checked when intermittent reception occurs
Intermittent reception, Microphonic operation (howling) Ringing sound in loudspeaker	1) tap each tube lightly with a small piece of wood or an insulated screwdriver handle. The offending tube, when tapped, usually will howl very loudly if microphonic or will give intermittent results if defective. Check '6A8 tube especially
Reception cuts off at certain dial settings	1) this condition is usually caused by some foreign metallic substance "shorting" a section of the condenser gang. These particles are often too small to be seen, but can be removed by blowing them out with an air-pressure hose or an ordinary handpump. Great care must be taken not to destroy the thin mica insulators assembled under the trimmers on top of the condenser gang
Dial light does not light	1) dial light bulb may be loose in socket, broken, or burned out. Socket on the end of lead in the rear of the control head can be pulled straight out
Weak, Insensitive	1) check the car antenna for poor connections and grounds 2) check all tubes 3) check the vibrator—or substitute new one 4) check receiver alignment

(Cont'd)

BOSCH 636, 637, 736A2, 737A2, 738A2 —1936-Model Auto Radio Receivers—*(Cont'd)*

Weak or insensitive after realignment	1)	check coils and associated circuits in the deficient "stages" of the receiver for proper resistance values
Low power output (B-voltages all check O.K.)	1)	check the speaker field coil, voice coil and associated audio circuit for resistance continuity and faulty condensers
Vibrator interference ("hash")	1)	check with ignition turned "off" and antenna disconnected. Check, clean and tighten the spring contact on the bottom of the receiver housing
Buzzing sound in speaker	1)	this can be remedied in many cases by blowing out foreign material with an air hose. It may also be caused by a loose voice-coil winding. In such a case, the turns of the winding should be carefully pushed together and a thin coating of collodion or coil cement should be applied to hold the windings in place
Rattles	1)	check the receiver for loose cover thumb screws and housing screws. Rattles seemingly in the radio receiver often are traced to loose parts on the bulkhead or dashboard of the car, which are set into vibration by the sound waves
Poor tone quality	1)	foreign material is apt to become lodged between the speaker voice coil and the field core. This hampers the movement of the speaker diaphragm. As rear of speaker is open, this space can be cleaned with an air hose or hand pump

Engineering changes which have been made in these receivers:

1) on early models 736, 737, 738 the following changes were made to make these models 736A2, 737A2, 738A2.
   (*a*) the type '6J7 r-f tube was changed to a type '6K7
   (*b*) the 0.005-mfd. 600-volt condenser from plate of the '6F6 output tube to "ground" was changed to a 0.008-mfd. mica condenser
   (*c*) a 0.0005-mfd. mica condenser was added from the grid of the '6F5 audio tube to "ground"
   (*d*) the type '6A8 detector oscillator tube was placed on AVC by removing the jumper from terminal on r-f coil to ground, and connecting this terminal by a jumper to the terminal on the antenna coil to which the red and yellow lead and the 100,000-ohm resistor are connected

BOSCH 812CK

Motorboats upon starting, then develops a shrill whistle	1)	replace the condenser having a brown lead from the can. Cut the lead close to the can, and connect a new 4-mfd. unit from the voltage-divider strip to ground

BOSCH—All 1937 Models

Inoperative	1)	common trouble is broken voice-coil leads. The wire with which the voice-coil is wound is simply cemented to the cone at the point of its emergence from the coil, a length of insulation slipped over it, and then led up about 4 or 5 inches to the output transformer terminals. The wire is not flexible enough, and eventually breaks inside the tubing, causing non-operation. The trouble is simple but if not properly corrected will soon re-occur. To correct, remove the cone from the speaker (using "thinner" to loosen the rim) then cement to the cone, new leads of special flexible voice-coil lead wires. Replace and recenter the cone

BRANDES

(See listings under "KOLSTER-BRANDES")

BREMER TULLY

BREMER TULLY (Brunswick) S8

Volume control erratic	1)	fibre in volume control projects too high at places, causing the rotor arm to miss contact with the resistance element. Push fibre down in place—or, replace control

BREMER TULLY S81

See also the Case Histories listed for Bremer Tully S82 receiver

Scratchy noises, Distortion	1)	replace the purple 1-megohm grid leak on the first a-f tube with a ½-megohm unit
	2)	check the 0.01-mfd. coupling condenser for leakage
Hum, Fading	1)	replace the three control-grid leads to the caps of the three r-f tubes—using good flexible wire

BREMER TULLY S82

A. C. Hum	1)	breakdown in the 0.275-mfd. condenser used to tune one of the filter chokes to the ripple frequency. To check it, disconnect the condenser when set is in operation. Hum will *decrease* if it is broken down. Replace with a condenser of similar value
Weak reception	1)	one of wires to the ballast tube "open"
	2)	r-f cathode by-pass condenser "shorted". Replace with a 0.5-mfd. unit
Whistling or squealing (all by-pass condensers test O.K.)	1)	unsolder both wires from "local-dx" switch at the antenna loading coil. Remove bakelite strip supporting this coil. Unsolder the two fine wires from the coil at the terminal lugs, reverse their connections to the lugs, and re-solder them

BREMER TULLY 640, 641

Inoperative	1)	if ohmmeter indicates a "short" between the plate of the '71A tube and the chassis (and inspection shows that the socket is not at fault), the trouble is likely due to receding of the insulation on the plate lead of the output transformer (which is housed in a metal container under the chassis with other audio transformers). The bared lead is likely "shorting" to another normally bare wire at ground potential. Though short occurs within container, the following procedure will likely clear trouble without breaking can open. Apply hot soldering iron to lug which connects to the transformer lead (coming up through hole in lug) with external lead going to 71A plate. When solder starts to melt, grasp transformer lead with pliers and gently draw as much of it from inside of can as possible. Wind wire brought out around lug and solder to prevent wire from slipping back. The remainder of lead within container is now likely insulated throughout its entire length and the "short" removed
Whistling or squealing	1)	if oscillation persists after interchanging the old tubes in the r-f stages, installing new '26 type tubes in them, adding to the length of aerial . . . turn adjusting screw of compensating condenser (connected between plate and grid of first r-f tube) counter-clockwise until oscillation ceases
Volume control does not function properly	1)	volume control resistance element worn in spots. Replace

BROWNING

BROWNING 35

Inoperative (overheating and smoke)	1)	"shorted" 0.05-mfd. by-pass condenser connected from plate supply to cathode of first-detector tube. This puts high potential across the 350-ohm first-detector cathode resistor which will burn out if the current is left on very long. Replace condenser. Check resistor

---

BRUNSWICK

BRUNSWICK PANATROPES

Low volume when playing records, (chassis O.K.)	1)	replace damping rubbers on pick-up head with new "live" rubbers
	2)	poor contact at phono-switch points. Clean with alcohol

BRUNSWICK PR-17-8

Hum, Weak reception, No bias on first r-f tube	1)	volume control arm not making contact
Whistling or squealing	1)	"open" '26 tube filament by-pass cond.

BRUNSWICK 2-KR-6

Same Case History as that listed for RCA Radiola 17, 18

BRUNSWICK 2-NC-8

Same Case History as that listed for RCA Radiola 62

BRUNSWICK Panatrope 3-KR-8

Low volume from phono pickup (O.K. on radio reception)	1)	poor contact at phono-switch points

BRUNSWICK 3-NC-8

Inoperative above 600 kc, Dial settings incorrect	1)	snapped tabs on oscillator series condenser
Weak reception	1)	carbonized 20,000-ohm carbon bleeder resistor—change to wire-wound unit
Insufficient sensitivity	1)	shunt 40-ohm section of flat wire-wound voltage divider near volume control with a 500-ohm unit
Insensitive at high or low-frequencies	1)	oscillator trimmers out of adjustment
	2)	r-f compensator condenser out of adjustment
Distortion, Weak reception	1)	open-circuited a-f transformer primary
Distortion at low volume	1)	broken spider on speaker cone
Unstable, Whistling	1)	open-circuited oscillator grid leak
Hum	1)	partially shorted spk'r rectifier stacks
	2)	remove speaker frame ground connection
House fuse blows	1)	"shorted" speaker rectifier stacks

BRUNSWICK 3-NW-8

See also Case History listed for RCA Radiola 64 receiver

Inoperative below 600 kc, Dial settings incorrect	1)	partially short-circuited speaker rectifier stacks
Intermittent	1)	snapped tabs on oscill. series cond.
Weak reception, Inoperative	1)	open-circuited 1-megohm AVC grid resistor
Insensitive at either high or low-freq.	1)	oscillator trimmers out of adjustment
	2)	r-f compensator condenser out of adjustment
Tuning meter fluctuates	1)	shunt a 0.0001-mfd. condenser across meter
Distortion, Weak reception	1)	open-circuited a-f transformer primary

BRUNSWICK 5-KR, 5-KRO, 5-KR-6

See also Case Histories listed for RCA Radiola 17, 18 receivers

Weak reception, No bias on first r-f tube	1)	volume control arm not making contact
Poor selectivity, Low sensitivity	1)	adjust r-f compensating condenser
Whistling	1)	open-circuited type '26 tube filament by-pass condenser
Whistling on high-frequencies	1)	adjust r-f compensating condenser
Whistling over entire dial	1)	open-circuited by-pass condenser across split primary winding of second and third r-f stages
Distortion, (high detector plate voltage)	1)	open-circuited detector-plate limiting resistor

BRUNSWICK 5-NC-8

Same Case Histories as those listed for Brunswick 3-NC-8 and RCA Radiola 62 receivers

BRUNSWICK 5-NO

See also Case History listed for RCA Radiola 60 receiver

Distortion, Weak reception	1)	open-circuited a-f transformer primary
Distortion at low volume	1)	broken spider on speaker cone
Weak reception	1)	carbonized 20,000-ohm carbon bleeder resistor—change to wire-wound unit
Insufficient sensitivity	1)	shunt 400-ohm section of flat wire-wound voltage divider near volume control with a 500-ohm unit
Insensitive at high or low-frequencies	1)	oscillator trimmers out of adjustment
	2)	r-f compensator condenser out of adjustment
Inoperative above 600 kc, Dial settings incorrect	1)	snapped tabs on oscillator series condenser
Unstable operation	1)	open-circuited oscillator grid leak
Whistling or squealing	1)	open-circuited oscillator grid leak

BRUNSWICK 10-AC

No reception at low-frequency end of dial	1)	several plates in gang condenser "shorting" together
Weak signals, Whistling	1)	voice coil in speaker "open"
	2)	det. plate resistor (0.5 meg.) carbonized
	3)	4,100-ohm screen-drop resistor carbonized
Scratchy sound (similar to defective audio transformer)	1)	defective "Candohm" resistor. Cut wires in each section for a considerable distance with a sharp knife and solder a 10,000-ohm, 10-watt resistor across the high-voltage section and a 5,000-ohm, 10-watt unit across the low-voltage section. The original terminals of the unit are excellent for connecting lugs
Failure of the tuned filter system	1)	replacement of entire block is necessary. If this is difficult to secure, the following may serve as a substitute: Connect a 0.0005-mfd. condenser from the type '47 tube control grid to chassis, a 0.01-mfd. condenser from one side of switch to chassis, a 12-mfd. electrolytic condenser from the high-voltage end of the "Candohm" resistor to chassis and an 8-mfd. condenser from the type '80 tube filament to the center-tap of the high-voltage winding. If necessary, a tone condenser may also be connected between the tone switch and the chassis (capacity 0.02-mfd.)
Other common troubles	1)	"open" volume control
	2)	faulty 1-mfd. condenser
	3)	faulty screen by-pass condensers
	4)	faulty 0.0005-mfd. condenser from cathode to plate of the '24 detector

BRUNSWICK 11, 12

Inoperative, (positive control-grid bias on 1st detector tube)	1)	"shorted" 100-mfd. mica coupling condenser mounted on one end of the stator portion of the first detector tuning condenser section
Inoperative over part of tuning range	1)	broken porcelain turret condenser brackets
Weak (or no reception) on low-frequency end of dial	1)	check for "open" 910-mmfd. condenser located between stator of oscillator tuning condenser and "high" side of oscillator plate coil
Low volume, Inoperative	1)	charring and change in value of the 14,000-ohm, 2-watt resistor connected in series with a ⅛-watt, 5,000-ohm resistor (in the case of the type '24 oscillator) and another ⅛-watt, 5,000-ohm resistor as a bleeder to ground. Very often these resistors burn out entirely. Replace with 2-watt, ½-watt and 1-watt units respectively
Intermittent reception	1)	loose internal connection of oscillator plate by-pass condenser
	2)	broken porcelain turret condenser brackets, causing "shorted" tuning condensers
	3)	short-circuiting first detector coupling condenser (fastened to stator of first detector tuning condenser)
	4)	lugs on r-f coil forms shorting to chassis within shields
	5)	coil leads snapped at lugs—making contact intermittently

(Cont'd)

BRUNSWICK 11, 12—*(Cont'd)*

Fading, Poor selectivity or sensitivity	1)	tighten screw which fastens 10-mmfd. mica-coupling condenser to stator section of first-detector condenser
Distortion, Hum, Oscillation	1)	capacity of 6-mfd. electrolytic filter condenser below normal
	2)	carbonized 5,000-ohm resistors in voltage-divider circuit
	3)	screen voltage drop resistor carbonized
No control of volume	1)	grid returns in r-f, mixer, and i-f stages short-circuiting to ground
Poor high-frequency response	1)	remove the small 0.001-mfd. condenser connected to the second detector plate. Replace with a 0.00025-mfd. unit
Slipping condenser drive	1)	raise volume-tone control assembly by insertion of small washers

BRUNSWICK 14, S14

Inoperative	1)	lugs on coil form shorting to chassis or shield
	2)	broken turret cond. porcelain brackets
Inoperative (low plate voltages)	1)	short-circuited 1-mfd. condenser across the output of the filter circuit. Replace with new unit
	2)	"shorted" plate by-pass condenser
	3)	"faulty" local-distance switch
Inoperative, (high positive control-grid bias voltage on first detector tube)	1)	short-circuited first detector coupling condenser mounted upon stator of first detector tuning condenser
Inoperative-distorted reception	1)	leads from audio transformer shorted to chassis
Insensitive on high frequencies, Inoperative below 650 kc	1)	change oscillator tube
Weak reception (voltages and resistances check O.K.)	1)	leaky condensers across the two grid terminals of the type '45 power tubes (this does not show up in a point-to-point test). Replace with new 0.00025-mfd. units
Weak reception	1)	wind a 3 to 5 turn "capacity-coupling" coil at grid end of each r-f secondary coil. Connect one end to plate of preceding tube. Leave other end "open"
	2)	faulty r-f coupling condensers (mounted directly on the gang-condenser housing)
Full volume for minute or so after receiver is switched on	1)	leaky insulation between first electrolytic condenser and chassis
Fading, Rapid changes in volume under vibration	1)	short-circuiting of small black by-pass condensers located next to each 5-prong socket. Test each by substituting with a 0.25-mfd. condenser
Fading, Intermittent reception, (insertion of analyzer plug in socket or pulling out type '45 push-pull tubes, restores set to normal operation) (tubes and voltages check O.K.)	1)	intermittently open-circuiting a-f transformer secondary. Replace with new transformer

(Cont'd over)

BRUNSWICK 14, S14—*(Cont'd)*

Intermittent reception, Fading	1)	loose internal connection to 0.5-mfd. oscillator plate by-pass condenser
	2)	lugs of coil forms shorting to chassis
	3)	broken turret cond. porcelain brackets
	4)	snapped coil windings at lugs of coils
	5)	short-circuiting first detector coupling condenser
	6)	defective or loosely connected 0.1-mfd. screen grid by-pass condenser in the detector circuit. Check its condition, replacing if defective and solder its riveted connections
	7)	intermittently open-circuiting 0.001-mfd. condenser connected between the grid and plate of the type '24A detector tube. Replace with new unit
	8)	high-resistance connection to control-grid of second r-f tube
Weak reception—low secondary voltages accompanied by slight glow in ballast tubes	1)	if all filter condensers check O.K., this trouble is usually due to fact that there is insufficient iron in the power transformer core. Install a new transformer
No control of volume	1)	leakage between first electrolytic filter condenser insulation and chassis
	2)	leaky 0.02-mfd. r-f or first detector tube secondary return by-pass condenser
	3)	leaky 0.1-mfd. i-f secondary return by-pass condenser
	4)	speaker leads shorting to frame of speaker or terminal cover
	5)	carbonized screen voltage dropping resistor
	6)	vol-control shaft "shorting" to chassis
Distortion at any volume level, Speaker field overheats	1)	screen drop resistor carbonized to lower value
	2)	two 5,000-ohm carbon resistors in plate voltage divider circuit carbonized to lower value
	3)	3rd electrolytic cond. capac. below normal
Noise and motorboating	1)	replace leads from tuning condenser stators to tube grids. Increase the tension on the phono switch blades, and clean the contacts if necessary
Hum, Oscillation, Mushy	1)	open-circuited section of filter condenser block—especially faulty small fixed condenser which tunes the filter choke
	2)	unbalanced, gassy, or otherwise faulty power tubes
	3)	loose power transformer laminations
	4)	in Models 31 and S31, it may be due to magnetic coupling between the pick-up coupling transf. and the phonograph motor. Shift position of the transf.
	5)	change *purple* 0.1-megohm resistor (located in the power unit directly above the 27 tube) to a 0.25-megohm unit. Change the tubular 0.1-mfd. detector screen grid by-pass condenser (located alongside the detector socket) to a 0.5-mfd. unit
Hum at resonance, Whistling	1)	r-f amplifier out of neutralization
Noisy tuning	1)	burrs on plates of tuning condensers (burn off with high voltage—all leads disconnected)
Noisy reception	1)	poor contacts on "local-distance" switch

(Cont'd)

Brunswick 14, S14—*(Cont'd)*

Intermittent phono operation	1)	loose terminal of tubular condenser connected to terminal of transfer switch (for Brunswick S-31 only)
Slipping tuning dial drive	1)	raise volume-tone control assembly by inserting small washers
	2)	increase tension of cable drive spring by moving screw, to which spring is attached, forward in slotted hole
	3)	apply drop of oil to tuning gang shaft bearing and pulleys
Improving Model 14 or S-14, 21 or S-21, and 31 or S-31 receivers	1)	the r-f coupling system may be greatly improved by substituting transformer coupling for the present choke-condenser r-f coupling system. Remove the r-f chokes and wind 25-turn primaries on each grid coil in order to make transformers out of them. The coupling condensers are automatically removed with the choke coils. This change will greatly improve the volume

BRUNSWICK 15

Inoperative receiver, (high positive control-grid voltages on r-f tubes)	1)	corroded condenser gang rotor contacts. Bond rotors to chassis with flexible wire pigtails
No reception, Weak reception on lower end of dial	1)	shorted screen-grid by-pass condensers
	2)	readjust trimmers on tuning condenser
Reception dies out after set is on a while	1)	25,000-ohm *orange* resistor in screen-grid supply circuit "open"
Weak reception (low detector plate voltage)	1)	check all r-f coupling condensers and replace all "leaky" or otherwise faulty ones found (they are mounted directly on the gang condenser housing)
Intermittent reception	1)	poorly-riveted contacts on audio coupling condenser
	2)	open-circuiting 0.25-mfd. screen or cathode by-pass condensers in r-f stages
	3)	check by-pass condenser just behind '45 tubes against rear wall under chassis
	4)	unsolder the pigtail from the second r-f variable condenser stator, remove the rubber sleeve, blow out powderlike substance found in it, wipe off pigtail, replace sleeve and resolder pigtail in place
Changes volume, Noisy	1)	replace 35,000-ohm screen grid resistor
	2)	loose rivet holding antenna post on insulating strip
Weak reception, Choked and distorted	1)	speaker output condenser "shorted"
	2)	poor connection to 4-megohm resistor in detector secondary-return circuit
Distortion (reception otherwise O.K.)	1)	short-circuited detector screen by-pass condenser. Check it with a neon lamp or condenser tester, as this condenser often "shorts" without affecting receiver voltage readings enough to detect it
	2)	audio distortion is usually accompnaied by lack of C-bias on the power tubes. Caused by "short" in bias resistor. Ohmmeter check between one of the '45 filament terminals to the chassis should give reading of approx. 800 ohms—the value of the bias resistor. Lack of any reading indicates an "open" bias resistor —a "zero" resistance reading indicates a "shorted" bias resistor

(Cont'd)

BRUNSWICK 15—(*Cont'd*)

Whistling or squealing	1)	0.1-mfd. condenser across speaker socket "open". This condenser is in the condenser pack and has green leads
	2)	bond speaker frame to receiver chassis, and use a good outside ground on receiver
	3)	"open" r-f by-pass condensers (in *black* bakelite cases between tube sockets)
Noisy tuning, Squealing	1)	corroded condenser gang rotor contacts. To get at contacts, drill a hole large enough to permit insertion of a screwdriver through drum and chassis in line with the contacts
Noisy volume control,	1)	poor or corroded connection of copper strip to plunger of volume control
"Put-put" (motorboating) sound	1)	weak 4½-volt "C" battery
Station "hiss" (switch in "local" position)	1)	remove 0.0002-mfd. condenser connected from one side of the "local-distance" push-pull type switch to chassis
Rushing noise (like escaping steam), strongest at lower end of dial	1)	remove shunt condenser across local-distance push-pull type switch. No replacement is necessary
Noisy reception, Intermittent reception	1)	defective 0.02-mfd. coupling condenser in a-f circuit. Replace with new unit
	2)	inspect set thoroughly mechanically
	3)	check the 35,000-ohm orange-colored r-f screen grid resistor. Replace if necessary
	4)	check the red 60,000-ohm screen bleeder resistor—especially if set oscillates
	5)	check for faulty cathode bias condensers
Resonant hum and fading	1)	remove the 0.00025-mfd. condenser soldered to "local-distance" switch. If fading is found, test (by substitution) the small black oblong by-pass condensers located next to each "Y" type socket. These often cause rapid changes in volume—especially under vibration
A. C. hum (loud)	1)	"shorted" 0.14-mfd. shunt tuning condenser across filter choke. Often a 0.1-mfd. condenser proves a satisfactory replacement. If not, remove this tuning condenser entirely, and use larger condensers in the main filter system

BRUNSWICK 15S

Weak reception, Intermittent reception	1)	often caused by high-resistance connections developing in the control-grid circuits. Go over all connections in these circuits with hot soldering iron

BRUNSWICK 16

See also all Case Histories listed for Brunswick 11, 12 receivers

Inoperative (all voltages normal)	1)	oscillator screen resistor changed value, and tube not oscillating. Replace with a 5000-ohm ½-watt unit
Fading, or abrupt interruption of reception (all voltages normal)	1)	find and check the 10-mmfd. coupling condenser mounted on the bottom of one of the turret condensers with a machine screw. Tighten this screw. This condenser connects between the r-f tube and first detector

(Cont'd)

BRUNSWICK 16—(*Cont'd*)

Weak reception	1)	detector plate resistor carbonized
	2)	try changing the screen bleeder resistor from 14,000 to about 10,000 or even 7,500 ohms
Weak, or no reception, at low-frequency end of dial	1)	check for "open" 910-mmfd. condenser located between stator of oscillator tuning condenser and "high" side of oscillator plate coil
Noisy volume control	1)	dirty contacts inside of volume control. Take apart and clean
Distortion (voltages below normal)	1)	check 5,000-ohm oscillator screen resistor for abnormally low value, practically "shorting" screen to ground
	2)	replace all faulty carbon resistors

BRUNSWICK 17 SERIES

See also all Case Histories listed for Brunswick 11, 12 receivers

Inoperative, (tubes light up)	1)	high-voltage "short" to speaker frame
	2)	grounding of 14,000-ohm screen-grid resistor located in the right half of the chassis between the two coil shields
	3)	change in value of the two 5,000-ohm resistors in oscillator stage. Replace
	4)	short-circuited 0.5-mfd. condenser in the plate circuit of the oscillator stage
Intermittent reception, Fading	1)	check for ends of coils snapping at the lugs and making intermittent contact thereto
	2)	check lugs on coil forms for "shorts" to chassis within the coil shields. Place insulating paper between the coil and the shield
	3)	open 0.5-mfd. oscillator plate by-pass condenser—due to broken connection inside the shield housing of the condenser. Replace
	4)	breaking of the porcelain insulators of the "turret" condenser gang, causing stators to shift and "short" to rotor
Intermittent reception, (set becomes operative when someone walks across floor)	1)	peeling of tuning condenser plates, causing intermittent short-circuits between them. Burn with high voltage—all terminals disconnected
Weak reception	1)	open-circuited r-f and i-f control-grid return circuits
	2)	open-circuited by-pass condensers
Distortion, Weak reception	1)	intermittent cathode-to-heater "short" in the type '51 second detector tube
Fading, (several seconds after intensity of signal builds up to high level; resuming normal operation after a few seconds)	1)	slow-heating tube in the AVC stage, while the rest of the tubes are "quick heaters". Replace with quick heating tube
No control of volume, Distortion	1)	leakage between the can of the first electrolytic condenser and the chassis, due to poor quality fish-paper insulation
	2)	decrease in value of the screen-grid

(Cont'd over)

BRUNSWICK 17 SERIES—(*Cont'd*)

No control of volume, Distortion —(*Cont'd*)		voltage dropping resistor, located between the two i-f transformers. This results in a consequent decrease in value of the two 5,000-ohm, 0.5-watt resistors which are used to obtain the oscillator plate voltage. Replace the former resistor with a 15,000-ohm wire-wound unit and the smaller one also with the same type unit
	3)	cathode-heater leakage in the r-f and i-f tubes. Replace with new tubes
	4)	speaker terminal shield short-circuiting to one or more terminals

BRUNSWICK 18

See also the Case Histories listed for Brunswick 11, 12 and 16 receivers

Inoperative, Low volume	1)	install an I.R.C. 14,000-ohm 2-watt resistor in place of the 14,000-ohm *carbon* type screen-voltage resistor now located between the two i-f coil cans mounted under the panel

BRUNSWICK 21, S-21

Same Case Histories as those listed for Brunswick 14

BRUNSWICK 22

See also all Case Histories listed for Brunswick 15 receiver

Fading	1)	connecting-lug of input winding on one of the r-f coils short-circuiting to shield can intermittently. Insulate the lugs with tape to eliminate recurrence of this trouble
	2)	corroded joints at the local-distance switch. Replace with new unit
	3)	defective "Bradley" unit tone control. Replace with a new unit
	4)	"shorting" of small *black* bakelite bypass condensers located next to tube sockets
Hum	1)	remove small 0.00025-mfd. condenser that is soldered to the local-distance switch

BRUNSWICK 23

Fading, Poor selectivity, Poor sensitivity	1)	tighten screw which fastens 10-mmfd. coupling condenser to stator section of first-detector tuning condenser

BRUNSWICK 24

Same Case Histories as those listed for Brunswick 17 and Brunswick 25 receivers

BRUNSWICK 25

See also Case Histories listed for Brunswick 17

Insensitive on high frequencies,	1)	try replacing the oscillator tube (even if it tests O.K.)
Inability to tune below 650 kc	2)	make certain that porcelain insulators on the turret condenser gang are not broken
Noisy reception, Noisy when tuning	1)	check for "burrs" on the plates of the tuning condensers. Disconnect all leads to condensers and "burn" off burrs by high-voltage method
Replacing power transformer	1)	power transformer burnouts are quite frequent on this model. Use high grade replacement. Do not use centertaps on heater windings — install centertapped resistors at filament circuits instead. Filament winding supplying the 47 tubes is resistance-centertapped externally

BRUNSWICK 31, S-31

Same Case Histories as those listed for Brunswick 14

BRUNSWICK 32

Same Case Histories as those listed for Brunswick 15

BRUNSWICK 33

See also all Case Histories listed for Brunswick 11, 12 receivers

Radio reception interference during playing of records	1)	lead to "change-over switch" snapped

BRUNSWICK 42

See also all Case Histories listed for Brunswick 15 receiver

Strong vibration, Mechanical hum	1)	solenoid improperly centered
	2)	hardening of rubber damper in solenoid
Mechanism stops after few revolutions	1)	adjust cycle switch
Mechanism slows down or stops during operation cycle	1)	clean motor brushes and commutator
Records reject continuously	1)	jammed solenoid plunger
	2)	insufficient tension of stop lever spring
Record rejecting mechanism inoperative (motor operates)	1)	burnt-out or open-circuited solenoid
	2)	too much tension on stop lever spring
Records are not rejected	1)	contacts on tone-arm switch fail to open, usually because they are set too close together. Adjust the contacts so that they open when the end of the record is reached
Record-rejecting mechanism resumes another rejecting cycle immediately after completing one and before record is played	1)	defective contact blades on the cycle switch, which fail to open when the cycle is ended. Adjust the switch so that the contacts will open when the cycle is ended
Pick-up lowers off record	1)	cabinet not level
Pick-up lowers past first record groove	1)	cabinet not level
	2)	tension of suspension arm spring too great
Needle does not slip into first record groove	1)	insufficient tension of suspension arm spring
Mechanism jams, Records jam, Records split	1)	record gate incorrectly adjusted
	2)	records warped

BRUNSWICK 81, S-81, 82, S-82

Same Case Histories as those listed for Brunswick 14 receiver

BRUNSWICK 83

Weak reception (voltages check O.K.)	1)	reduce 100-ohm wire-wound screen cathode resistor down to 50 or 25 ohms
	2)	melt wax off and reverse r-f choke and antenna loading coil leads to position of max. signal strength
	3)	re-align condenser gang
	4)	"shorted" or "grounded" pigtail carbon resistors

(Cont'd)

BRUNSWICK 83—*(Cont'd)*

"Put-put" (motorboating) sound	1)	"open" small 0.1-mfd. tubular condenser fastened to large 0.5-mfd. tubular condenser mounted under r-f amplifier section
Whistling or squealing	1)	open-circuit in the 0.5-mfd. tubular condenser mentioned above
	2)	"shorted" or "grounded" pigtailed carbon resistors
Hum (*B* voltage low)	1)	'45C-bias resistor shorted
	2)	braided tubing on push-pull transformer leads to resistor strips "charred", forming high-resistance "grounds" to chassis
General frequent difficulty	1)	a large proportion of the trouble found in these receivers is caused by "shorts" or "grounds" in the pigtail carbon resistors. It is well to check them whenever you are working on the chassis—and replace all units found faulty

BUICK — (United Motors Service) Auto Radios

BUICK 1933 Auto Radio

Brake static	1)	loose cotter pin in front wheels. Place a lock washer under each pin to hold it tight

BUICK 1934 Auto Radio

Whistling (steady), "Put-put" (motorboating) sound	1)	"break" in the lead of an r-f cathode by-pass condenser. Look for this trouble in largest condenser of a cluster of three, jammed between lid and other two

BUICK 1936 Auto Radio

Weak reception	1)	realign i-f stages at 610 kc and low-frequency padder at 600 kc (goes out of alignment due to temperature change)
Volume drops periodically	1)	speaker field coil "opens" spasmodically. Check the black wire from the field coil. This is riveted to the frame of the speaker, and often does not make a good "grounding" contact
Hum	1)	'75 tube faulty

BUICK (B. O. P.) 980393 Auto Radio

Inoperative over part of broadcast band	1)	check bias resistor connected between second 36 tube cathode and ground. Replace with 1-watt unit

BUICK 980526 Auto Radio

Weak reception	1)	check volume control for appreciable increase in resistance above the normal 1-meg. value

BUICK 980535 Auto Radio

Intermittent reception in car; tests O.K. on bench	1)	faulty soldered connections at 5-prong speaker plug for external speaker. Resolder

BUICK 1304873 (980566) Auto Radio

Fuse blows repeatedly	1)	insulation on shielded grid lead of 6R7 tube worn through and contacting filament prong

BULOVA

BULOVA M501

Same Case Histories as those listed for Brunswick 10-AC receiver

BURLEY

BURLEY 31

Inoperative, Intermittent operation	1)	"open" primary winding in push-pull input transformer

BUSH & LANE

BUSH & LANE 10

Whistling or squealing	1)	check all r-f by-pass condensers
	2)	check the volume control
	3)	check the output filter
	4)	check excessive exposure of control-grid leads causing interaction between stages
	5)	check voltage-divider
	6)	try reducing the screen voltages by connecting the volume control to the extra tap provided on the voltage divider
	7)	try increasing the size of the r-f bias resistors
Hum	1)	remove the wire from the high-voltage end of the voltage-divider that goes to the filter condenser. Connect it to the junction of the choke and speaker field. Connect a 1-mfd. 300-volt paper condenser as an output filter condenser in place of the one whose position you changed

BUSH & LANE 12

Whistling over entire dial range	1)	faulty output filter

BUSH & LANE 20, 20B

Same Case Histories as those listed for Bush & Lane 10 receiver

CADILLAC (United Motors Service) Auto Radios

CADILLAC MASTER 1935 Auto Radio

Large 2,000-ohm resistor burns out	1)	secondary of last i-f coil short-circuiting to primary. Replace with new i-f transformer.

CADILLAC 1939 Auto Radio Antennas

Vacuum actuated antenna sluggish or unable to rise or drop	1)	remove two pipes which go to valve from antenna and work some windshield-wiper oil into the barrel of the antenna. (Do not use ordinary "3-in-1," or machine oil for this)
Noise—especially while car is running on rough roads	1)	if noise is traced to aerial, it is likely caused by a poor contact between the antenna lead and the antenna rod via the brush arrangement enclosed in the inaccessible air-tight barrel. Rub rod well with colloidal graphite where it enters the barrel so as to make better electrical contact

CADILLAC 06W Auto Radio

Poor tone when vol. is turned to low level	1)	replace volume control with a 500,000-ohm unit

CADILLAC C-8 Auto Radio

Push-buttons "stick" or fail to return to normal position	1)	remove unit of seven push-buttons. Inspect slots on each side of individual push-buttons. If any small polished ball bearings are missing from these slots, rub a light film of machine oil in the slots, then replace missing ball bearings

CAMDEN

CAMDEN 1480, 2480

Same Case Histories as those listed for Clarion 480 receiver

CANADIAN WESTINGHOUSE

(The Case Histories for these receivers are listed under WESTINGHOUSE (*CANADIAN*) receivers)

CAPEHART

CAPEHART 400 SERIES

Motor chatters when records change	1)	take down motor, clean and oil; grease gears and shaft seat; install thin armature shims
Records keep rejecting	1) 2) 3)	automatic-stop trip lever needs oiling hair-spring on clutch-throwout lever broken clutch gears set too close
Records do not hit spindle correctly	1) 2)	adjust record tray adjust magazine
Pick-up arm does not set on records correctly	1)	adjust pick-up arm lever hook
"On-Off" and phonograph switch defect	1)	fibre insulation worn. Take apart and back it up with metal; be sure it does not ground to shaft

CASE

CASE 80

Weak reception, Broad tuning	1) 2) 3) 4)	change detector to '56 power detection install a trimmer on each tuning condenser and align receiver for better selectivity, try shortening the aerial, or connect a 0.00025-mfd. condenser in series with it try throwing the last r-f stage slightly out of neutralization

CHAMPIONETTE

CHAMPIONETTE 5 TUBE MIDGET

Inoperative a few minutes after being turned on, Fading	1)	decrease in value of 25,000-ohm resistor connected between the plate and screen grid of the detector tube. Replace with new unit

CHEVROLET (United Motors Service) Auto Radios

B.O.P. CHEVROLET Auto Radio

Pronounced vibrator buzz	1)	if noise stops when '75 tube is removed, but is not affected when the grid of this tube is shorted to ground with a screwdriver, the filter output condenser is "open." Connect a 4-mfd. condenser from the B-plus of the '75 tube to ground
Dead (no plate voltage on one or both '89 tubes)	1)	connection inside female speaker plug broken by strain on speaker cable (the '89 plate lead or *B*-plus center-tap of the output transformer are the connections which usually break). Slip shielding back over cable about 1 inch, turn the plug cover and slip it back, exposing the lugs and the broken connection. (Chevrolet set and some United Motors models require a connection from the set chassis to speaker frame in order to operate when they are placed on test bench)

(Cont'd)

B.O.P. CHEVROLET Auto Radio—*(Cont'd)*

Motorboating, Steady whistle	1)	(in 1934 receivers) generally due to breaking of an r-f cathode by-pass condenser lead. Inspect the largest condenser of cluster of three, jammed between lid and the other two

CHEVROLET 364441 (1933 Model Auto Radio)

Inoperative over part, or all, of dial	1)	oscillator dead. Check the first (4,200 ohm) section of the candohm resistor strip, the 0.002-mfd. condenser across this strip, and the oscillator tube. If they are all O.K., replace the oscillator coil even though it checks O.K.
Noisy (noise disappears when antenna is disconnected from receiver)	1)	the noise is generally picked up by the shielded antenna lead which runs behind the instrument panel and is frequently in the inductive field of the cable running from the ignition key to the ignition coil of the car. Run the antenna lead at right angles to this cable
Vibrator failure	1)	remove chassis. Remove vibrator points. Dress the contacts carefully with a very thin fine Carborundum stone, and adjust them very close to the center points

CHEVROLET 1934 Model Auto Radio

Inoperative (or weak)	1)	open-circuited 3000-ohm section on resistor strip next to first '36 tube
Whistling, "Put-put" (motorboating) sound	1)	"break" in an r-f cathode bias by-pass condenser lead. Look for largest condenser of cluster of three jammed between the lid and other two

CHEVROLET 1935 Model Auto Radio

Weak reception (tubes and voltages check O.K.)	1)	if adjusting the first i-f transformer trimmer has no effect on the signal, check the transformer for excessive wax. Remove the wax by heating carefully in an oven—or, replace the entire unit. Realign the receiver (i-f peak is 262 kc)

CHEVROLET 500565 Auto Radio

Loud vibrator noise	1)	check filter condensers and replace

CHEVROLET 600249 Auto Radio

Low (or intermittently low) volume accompanied by poor bass response	1)	check primary of push-pull input transformer carefully. Trouble is not likely to affect any receiver voltages
Severe chassis pickup of noise	1)	see if ground lead is connected to the lighting switch. If so, move it to one of the door jamb bolts, or bond the dash to the door jamb bolts and to the firewall with heavy conductor

CHEVROLET 600565 Auto Radio

See also Case History listed for Chevrolet 600249 Auto Radio

Inoperative (vibrator buzzing O.K. but no plate voltages at sockets)	1)	faulty 0.04-mfd. vibrator condenser. Replace with one of exactly same capacity

CHEVROLET 601038 Auto Radio

Intermittent operation	1)	replace the 30,000-ohm screen grid dropping resistor

CHEVROLET 601574 Auto Radio

Inoperative (tubes light, vibrator dead)	1)	remove power transf. from can to get at oblong condenser connected to "A" line choke. Replace cond.
Improvements made by factory on sets carrying serial numbers above 0374000	1) 2) 3) 4) 5) 6) 7)	resistor *No. 44* changed from 30,000 ohms to 25,000 ohms resistor *No. 42* changed from 150,000 ohms to 250,000 ohms vol. control changed from 0.5-megohm to 1.5-megohms 750-mmfd. cond. *No. 28* removed from circuit—also 0.05-mfd. cond. *No. 18-C* 1,000-ohm resistor has been inserted in series with the B+ end of the second i-f transf. secondary condenser *No. 29* has been changed from 867 mmfd. to 950 mmfd. output tube changed from type 41 to 42

CHEVROLET 958200 Auto Radio

Fuse blows repeatedly	1)	check for "short" from 4-12 mfd. electrolytic can to ground. Remove clamp from can and insulate with heavy paper or varnished cambric

CHEVROLET 985254 Auto Radio

Whistling or squealing	1)	if a loud "pop" results when finger is touched to grid cap of the 6U7G i-f tube, replace it with a new tube
Distortion	1)	faulty 300,000-ohm volume control
Eliminating stubborn motor noise	1) 2)	when installing in '37 cars, try bonding the muffler to the frame also try omitting the ammeter by-pass condenser
Vibrator noise on all stations	1)	if rectifier, all condensers, and vibrator shield can check O.K., change the 6F6G tube to a Sylvania 6F6 tube

CHEVROLET 985255 Auto Radio

Intermittent reception	1)	remove chassis from case and examine the small 1-megohm resistor connected between the *No. 2* and *No. 4* prongs of the '6R7 tube socket. Vibration and jolts due to driving the car over bumps and rough roads frequently causes this small resistor to touch the *No. 3* prong (which is at plate potential). Unsolder and lengthen the wire so that the resistor cannot touch this prong. Check 3 cathode by-pass condensers in can near tuning condenser

CHEVROLET 985400 Auto Radio

Double-spot tuning on strong stations	1)	remove the AVC on the first r-f tube and apply it to the '6D6 i-f amplifier tube

CHEVROLET 985426 Auto Radio

Inoperative, Intermittent reception	1)	replace 2,500-ohm 2-watt carbon resistor connected from screen of 6KG tube to B plus

CHEVROLET 1940 Auto Radio

Intermittent reception	1)	look for broken voice coil lead—broken at lug

---

CHRYSLER Auto Radios

CHRYSLER 1940 Auto Radio Aerials

Reduced sensitivity	1)	due to water leakage at a point where the antenna rod passes through the upper stanchion. Such leakage dampens the connection of the bayonet plug at the top stanchion and, in severe cases, wets the cable itself for a considerable distance When this occurs the sensitivity and selectivity of the receiver are seriously impaired, to such an extent that only local stations can be received. This may either occur when the car is exposed to very severe rain or when the car is washed. The following simple corrective measure has been developed for such cases: A rubber washer should be placed over the prong of the antenna lead cable and the entire top of the lead securely seated in the top stanchion in accordance with antenna installation instructions. As a protective measure, this washer should be inserted as described above on every Chrysler radio installation that comes to you for service In extreme cases where the antenna has been exposed to the weather for a long period of time it may be found that some of the internal parts are corroded, in which case it will be necessary to remove the antenna and disassemble the upper stanchion for a thorough cleaning of the metal parts. Before reassembling the rod connected clips in the upper stanchion, apply a generous portion of lubricant When the antenna has been mounted on the cowl a small quantity of household cement, should be puddled around the rod where it enters the upper stanchion. In the event that the hole in the upper stanchion is slightly oversize, place a small amount of household cement around the rod where it enters the stanchion to seal the opening

(Cont'd)

Chrysler 1940 Auto Radio Aerials—*(Cont'd)*

Reduced sensitivity —(*Cont'd*)		*(Cont'd)*

CHRYSLER 1608 Auto Radio

Weak reception	1)	check antenna connections on primary coil and see that proper connections are made to *"SKY" JACK* or *"ROAD" JACK* terminals—depending upon which type of antenna is used

CHRYSLER C1708 Auto Radio

Excessive noise (when operated in large cities)	1)	reduce sensitivity of receiver by turning sensitivity control *counterclockwise*. This control may be reached by removing the wingnut holding the tube side cover. On the sub-base next to the 7B8 tube is a round disc with a screwdriver slot in the center. This is the control
Weak on all stations	1) 2)	high-resistance leak in 0.01-mfd. cond. from 7B6 plate to 7B5 grid see listing for "CHRYSLER 1940 Auto Radio Aerials"
Inoperative at low end of dial	1)	"open" oscillator coil. Realign after replacing

---

CLARION

CLARION—Most Models

Look for "shorts" between tube shields and top caps on 57 and 58 tubes.

CLARION A.C.-D.C. 5 TUBE RECEIVER

Low volume	1)	defective detector-plate load resistor

CLARION 40

See also Histories listed for TCA Chassis

"Popping" noise while set is warming up	1)	replace the 1-megohm grid resistor of the '47 tube with a ½ megohm unit
Uneven control of volume	1)	faulty 5,000-ohm vol. control pot.
	2)	connect a 100- or 200-ohm resistor in series with the low-potential end of the volume control and chassis, so as to prevent the possible reduction of grid-bias to zero
Poor selectivity	1)	short-circuited volume control
	2)	burnt-out antenna coil. Rewind with silk-covered wire
Whistling or squealing	1)	connect a 0.002-mfd. condenser from one side of power line to chassis
Excessive hum	1)	loose laminations in the filter choke

CLARION 51, 52, 53, 55, (A.C.)

Whistling, Intermittent reception, Noisy reception	1)	r-f cathode by-pass cond. "leaky", "open"
	2)	clean all rotor-wipers on condensers, or put them in if they are not already there to facilitate balancing
	3)	"open" ground strap between condenser frame and chassis
	4)	poor contact between variable condenser canopy and chassis
	5)	"open" screen by-pass condenser
	6)	"open" plate by-pass condenser
	7)	poor contact between the r-f choke and main choke
	8)	chassis base plate loosely attached to chassis
	9)	poor ground connection
	10)	tube shields not secure and making good grounding contact
Low volume, Low voltages	1)	"shorted" 1-mfd. condenser across the 900-ohm output bias resistor

CLARION 60, 61

Inoperative, Noisy	1)	primary of special a-f input transformer faulty. This receiver has a '24 detector tube, and use of an ordinary push-pull input transformer is not satisfactory for replacement, as it will result in poor tone quality. Unless a transformer *similar* to the original is available for replacement, resistance coupling should be substituted instead. To do this, leave the faulty transformer in, but disconnect the primary connections to it. Connect a 100,000-ohm resistor from the plate of the detector tube to the high-*B*-plus line, and connect a 0.01-mfd. 600-volt condenser from the detector plate to the grid of one of the '45 tubes
Intermittent operation, Noise	1)	inspect "local-distance" switch for loose contacts and terminals
Volume control burns out (on Model 60 receiver)	1)	check resistor shunting volume control for "open" or change in value
	2)	check rest of voltage divider for proper value
No detector plate voltage (in Model 61 receiver)	1)	"open" primary in push-pull transformer. If open, remove the transformer and take off wrapper. Usually, the break (due to corrosion) will be found right where the lead joins the winding—and can be repaired

CLARION 70

Selectivity poor	1)	volume control "shorted"
	2)	antenna coil burned out. Rewind with silk-covered wire of any size between No. 28 and No. 24

CLARION 80

Inoperative	1)	if 260-ohm resistor overheats, test *red* lead to by-pass condenser block for a "short"
Inoperative over high-frequency end of dial, accompanied by "put-put" (motorboating) sound	1)	"open" 27 oscillator grid resistor. Replace with 100,000-ohm unit

CLARION 90, 94, 95

Weak reception, (tubes and voltages check O.K.)	1)	replace the 0.05-mfd. (0.02-mfd. in models 94, 95, 160) condensers connected in the r-f and first detector tube grid-return circuits. These constitute part of the antenna and first detector coil assemblies. Remove the cans and replace
Inoperative	1)	defective 500,000-ohm resistor connected between the plate of the AVC tube and the r-f filament circuits. Replace with a unit of higher wattage rating

CLARION 100

Inoperative, Inoperative at high-frequency end of dial	1)	the oscillator circuit in the receiver employs a '24 tube which also functions as a detector (autodyne). The circuit is quite critical as regards tube characteristics, and usually the proper '24 tube for this use must be carefully selected by trial from a number of tubes. Realign the tuned stages. As soon as the new tube ages (possibly after a few months) the condition may reappear.
	2)	in many cases it has been found more satisfactory to use the old tube and decrease its control-grid bias by using a smaller value grid-bias resistor. A value of about 2,000 ohms in place of the 4,000-ohm unit is satisfactory

CLARION 160 Series

See also all Case Histories listed for Clarion 90, 94, 95 receivers

Noisy reception	1)	replace wire-wound, metal-clad 1000-ohm first-audio and AVC bias resistor with two 1-watt units (one of 300 ohms and the other of 700 ohms value)
Volume control inoperative	1)	check 0.35-mfd. condenser in plate circuit of second detector. Replace with 0.1-mfd. 600-volt unit
Intermittent reception	1)	check 0.00005-mfd. mica condenser in '27 oscillator grid circuit

CLARION 220

Inoperative, (11,000-ohm and 4,100-ohm voltage-divider sections O.K., i-f transf. primaries O.K.)	1)	change in value of 4,000-ohm bias resistor of type '24 autodyne det.-oscill. tube, preventing it from oscillating. Replace with a new 1-watt unit, soldering it to one end of chassis and by-passing it with the 0.001-mfd. mica-type condenser
Inoperative,	1)	change in value of 4,000-ohm resistor between oscillator coil and cathode of the detector-oscillator tube. Replace with a new 1-watt unit
	2)	open-circuited or loose control-grid wire to the type '24A detector-oscillator tube. This is a short piece of 1,000-ohm wire inside a sheath, making it difficult to detect an open circuit. Replace it with a plain wire lead connected in series with a 1,000-ohm, ½-watt resistor
	3)	"open" control-grid clip connection to the '24A detector-oscillator tube

(Cont'd)

CLARION 220—*(Cont'd)*

Inoperative (all over dial, or below 600 kc and above 1,400 kc)	1)	check the 11,000- and 4,100-ohm sections of the voltage divider, and the primaries of the i-f transformers
	2)	'24 tube (oscillator-first detector autodyne) may check O.K. in tube checker but does not oscilliate properly over entire band. Replace existing 5,000-ohm cathode bias resistor for this tube with a 4,000-ohm unit. Also disconnect the 0.35-mfd. second-detector cathode by-pass condenser and connect it to the screen grid of this tube. Connect in a 0.1-mfd. cond. for cathode by-pass instead. Realign
Inoperative (below about 1000 kc)	1)	oscillator padding condenser "shorted" or "leaky"

CLARION 240

Weak reception on short waves	1)	shunt the 200-ohm fixed i-f bias resistor with a resistance of about 75 ohms. This will reduce the bias on the i-f tubes
	2)	at the Police Band position of the selector switch, one contact is not being used. If a wire is run from this terminal to the terminal of the detector coil next to the antenna, it will short out the antenna choke and increase the volume

CLARION 260 AC, 25-260

To increase the sensitivity	1)	connect grid-return of second i-f transformer to a slightly "positive" point on voltage-divider (the a-f cathode tap will be a satisfactory point). This removes the noise-suppression feature by removing the delay bias from second detector
To equip receiver with phono-pickup	1)	insert a 5,000-ohm type pickup in the grid lead to the 56 audio tube. Shunt the pickup with a "shorting" switch

CLARION 280 A.C., 25-280

Poor tone	1)	incorrect connection at voice-coil or speaker field. Reverse connections at either point and note the effect
Intermittent operation	1)	change in value of one of the sections of the metal-clad voltage divider (*Part No. P4035*) located at side of chassis
To equip receiver with phono-pickup	1)	insert a 5,000-ohm type pickup in the grid leak to the 56 audio tube. Shunt the pickup with a "shorting" switch

CLARION 300

Poor sensitivity	1)	if tuning meter has a restricted swing when a station is reached, the trouble is likely in the circuits preceding the twin diode second-detector stage. If meter reads normal, the trouble is likely in some circuit between the second i-f stage and the speaker.
	2)	go over all connections at the antenna, oscillator, first-detector and oscillator coils with a hot soldering iron to eliminate any possible high-resistance connections here
	3)	faulty connection in grid cap of one of '58 tubes. Try new tube in each socket
Intermittent operation	1)	the same hints listed above for "Poor sensitivity" should be followed as regards the action of the tuning meter
	2)	faulty grid connection in the r-f oscillator or i-f stages. Will show up by a change in values of the receiver voltages and currents (measured with the set tuned to a constant signal) when the faulty part is tapped sharply

(Cont'd)

CLARION 300—*(Cont'd)*

Hum	1)	loose laminations in filter choke
	2)	short-circuited, or partially short-circuited filter choke winding
	3)	air gap disturbed (strike core with hammer)
Whistling, "Put-put" (motorboating) sound	1)	open-circuited 0.01-mfd. condensers bypassing first detector, first and second i-f secondary return-leads to ground
Intermittent whistling, Intermittent "put-put" (motorboating) sound, Weak reception	1)	open-circuiting 0.01-mfd. r-f, first detector, first i-f and second i-f secondary return by-pass condensers
To equip receiver with phono-pickup	1)	insert a 5,000-ohm type pick-up in the grid lead to the 56 audio tube. Shunt the pickup with a "shorting" switch

CLARION 320

Intermittent reception	1)	replace the fixed condenser in the cathode lead of the '57 oscillator-detector tube with a 0.0008-mfd. mica condenser
	2)	check first i-f transformer at point where flexible lead connects to coil winding. A poor connection may exist here
	3)	check 8,000-ohm oscill. bias-resistor
Fading, Set goes dead	1)	tube shields touching the control-grid caps of the i-f or r-f tubes. Wrap pieces of fish paper around control-grid caps
	2)	this receiver is sensitive to line-voltage fluctuations which cause the oscillator plate voltage to vary—with resultant fading. Connect an a-c voltmeter across power line to determine if the voltage changes when set fades. If so, install a line-voltage regulator
Hand-capacity effects	1)	most noticeable when a short antenna is being used. It is due to the fact that the pre-selector coil is located close behind front panel of the set, and the coil is unshielded. Use a longer antenna
Whistling or squealing	1)	"open" by-pass condenser, or a high resistance connection to by-pass condenser. First apply a hot soldering iron to all conections. Then test by shunting the various condensers with good ones of approximately the same size
	2)	if the "dress" of the wiring has been disturbed it may cause oscillation and even weak signals. This possibility should be checked
"Put-put" (motorboating) sound	1)	in early models, the suppressor grid of the '58 i-f tube is connected to ground. Connect it to the *cathode* instead

CLARION JR. 320

Rattling (especially at high volume)	1)	insert just a few drops of light oil between the pole piece and the voice coil. Use just a few drops—do not flood it

CLARION 340

No reception toward 600 kc end of dial	1)	replace 8,000-ohm bias resistor on 57 oscillator with a 6,000-ohm unit

CLARION 360

Excessive "boomy" bass response	1)	remove the permanent, fixed tone-control condenser and resistor from across the output circuit. Use the variable tone control on the receiver alone

CLARION 400

Weak reception	1)	check the dual 5-mfd. cathode condenser. Replace if faulty

CLARION 470

Intermittent reception, Distortion, Poor sensitivity	1)	replace the present 10,000-ohm type '2A6 tube bias resistor with a 5,000-ohm unit

CLARION 480

Intermittent reception, Volume drops abruptly, Resonance hiss, "Tunalite" action poor	1)	faulty, "open-circuiting" 0.02-mfd. grid filter condensers in r-f, i-f and first-detector circuits
Intermittent reception, "Tunalite" operates O.K.	1)	0.1-mfd. a-f coupling condenser (between the plate of the first-audio '56 tube and the control-grid of the driver stage) "opens"
	2)	poor contacts between "Tunalite" tube base pins and socket. Clean the pins and squeeze the socket contacts slightly to increase their tension
Weak reception, Choked, distorted, "Tunalite" action poor	1)	broken pigtail lead to the 0.25-megohm carbon resistor mounted on the "Tunalite" socket assembly
	2)	replace "Tunalite" bulb
Hum	1)	filter choke laminations loose
	2)	short-circuited, or partially short-circuited, filter choke winding
Fuses blow, Type '5Z3 rectifier tube burns out	1)	first section of dual filter condenser block leaky

CLIMAX

CLIMAX 1936 Battery Models

Noisy reception, Noisy	1)	replace first i-f coil with new 456 kc unit

CLIMAX 4-Tube A.C.-D.C.

Low volume, Weak reception	1)	open-circuit in the detector load resistor. Replace with a good 0.5-megohm, 1-watt unit. The detector plate voltage should be about 150-volts when the resistor has been replaced

CLINTON

CLINTON 52

Hum	1)	pickup by the grid lead to the 6C6 detector. Re-route the grid lead directly to top of tuning condenser (using shielded wire)

COLONIAL

COLONIAL 1933 Models

Microphonics, Noise	1)	try changing the detector tube
	2)	loosen the nuts on the four rubber-cushioned condenser-mounting studs. Make sure that neither the condenser shaft, dial, or knob touch the chassis or cabinet or the cushioning effect of the rubber mounting will be lost

COLONIAL 28

Inoperative	1)	"open" 160,000-ohm screen-grid resistor. Make the connections of the replacement directly to chassis to avoid long leads and to eliminate cathode coupling

COLONIAL 31 A.C.

Inoperative, No r-f bias voltage (even though r-f bias resistor tests O.K.)	1)	open-circuited center-tapped r-f filament resistor, which is sealed in the power transformer case. Replace by mounting a 10- or 20-ohm center-tapped unit on the transformer terminals
Weak reception, Broad tuning	1)	tuning condensers not synchronized
Hum at resonance, Whistling	1)	"open" 0.5-mfd. filament by-pass condensers in '26 tube circuit
Fuses blow	1)	short-circuited 1-mfd. line-buffer condensers

COLONIAL 31 D.C.

Receiver continues to play with switch off	1)	disconnect the ground lead while receiver is operating. If this stops reception, the 0.5-mfd. condenser in series with the ground lead is "shorted" (this is one of the three condensers at the left of the chassis when the set is turned upside down with the back of the set forward)

COLONIAL 32 A.C.

Inoperative	1)	broken tuning condenser mounting brackets
	2)	antenna lead shorting to metal braid
	3)	"shorted" condenser across grids of '45 tubes
Reception of one or two stations over entire dial	1)	tuning condenser shaft loose from pulley
	2)	broken tuning condenser drive
Weak reception at higher-frequencies	1)	tuning condensers not synchronized
Weak reception, Distortion	1)	open-circuited detector cathode bias resistor
	2)	open-circuited first audio cathode bias resistor
	3)	"open" field coil in dynamic speaker
Choked reception, Distortion (no output tube bias voltage)	1)	open-circuited 100,000-ohm resistor in secondary return of push-pull input transformer
Fading, Intermittent reception	1)	open-circuiting 0.1-mfd. audio coupling condenser
	2)	open-circuiting 0.1-mfd. detector secondary return by-pass condenser
	3)	open-circuiting sections of *4407-P* by-pass block in audio circuit. This condenser is located directly behind the push-pull input transformer and has 3 lugs on it
	4)	broken porcelain tuning-condenser mounting brackets
	5)	loose or broken volume control resistance elements

(Cont'd)

COLONIAL 32 A.C.—(*Cont'd*)

Fading, Intermittent reception —(*Cont'd*)	6)	poor or unsoldered connections to the carbon resistor pigtails
	7)	open-circuited or leaky sections of first, second, third r-f and detector by-pass condenser blocks
	8)	open-circuiting 750,000-ohm red carbon resistor in first r-f secondary return circuit
	9)	defective tubes (even though they test O.K.). Replace with new tubes by substitution
		Note: fading in this receiver as a result of defective tubes is often due to the double tube shields which provide poor ventilation. It may be well to drill large holes in the shield to provide better dissipation of the heat. In any event, adequate ventilation should be provided for the tubes
Whistling, General instability	1)	open-circuited 35,000-ohm resistor connecting from first r-f screen to chassis
Microphonic at resonance	1)	insert small felt washers between stator plates of tuning condensers
Noisy reception	1)	corroded or loose fuse-block clips
	2)	volume control carbon resistor elements caked or cracked
	3)	noisy 65,000-ohm carbon resistor in first audio plate circuit
Phono-radio switch trouble	1)	an "open" detector cathode-bias resistor (black resistor) will make the radio volume improve if the phono-radio switch is switched to the "phono" position. Replacing this resistor will eliminate this trouble

COLONIAL 32 D.C.

Fading, Intermittent reception	1)	open-circuiting 0.1-mfd. audio coupling condenser
	2)	open-circuiting 0.1-mfd. detector secondary-return by-pass condenser
	3)	open-circuiting sections of by-pass block in audio circuit
	4)	broken porcelain tuning condenser mounting brackets
	5)	loose or broken volume control resistance elements
	6)	poor or unsoldered connections to the carbon resistor pigtails
	7)	open-circuited or leaky sections of first, second, third r-f and detector by-pass condenser blocks
	8)	open-circuiting 750,000-ohm red carbon resistor in first r-f secondary return circuit
Poor selectivity	1)	"short" the 750,000-ohm red resistor from third r-f secondary return circuit
Weak reception	1)	connect a 0.5-mfd. condenser from one of the line r-f chokes to one side of power line

COLONIAL 33

See also Case Histories listed for Colonial 34

Inoperative, (no r-f plate or screen voltages)	1)	open-circuited 15,000-ohm section of voltage divider

(Cont'd)

COLONIAL 33—(*Cont'd*)

Inoperative, (no screen voltage)	1)	open-circuited 60,000-ohm section of voltage divider
Inoperative, (no first-audio plate voltage)	1)	open-circuited 50,000-ohm resistor in audio plate circuit
Inoperative, (no d-c voltages on any tubes)	1)	open-circuited 210-ohm section of center-tapped resistor in high-voltage secondary return circuit
Inoperative, (no output tube plate voltage)	1)	open-circuited 800-ohm bias resistor
Low volume	1)	receiver circuits out of alignment
	2)	open-circuited aerial connection
	3)	open-circuited 60,000-ohm screen-grid resistor section of the three-section voltage divider located near the two r-f screen-grid tube sockets. Replace with a 25,000-ohm unit in order to obtain an increase in volume
	4)	sensitivity may be increased by loosening each individual coupling coil on its shaft and adjusting it for maximum-gain position. Then re-align the compensating condensers
Weak over entire dial	1)	open-circuited band selector coupling coil
Low volume, Distortion, (low plate or screen-grid voltage; high grid-bias voltage)	1)	change in value of "lavite" or graphite voltage-divider resistors or high-resistance contacts at their terminals. Check the resistance values and go over the connections with a soldering iron
Weak reception, Distortion	1)	open-circuited 100,000-ohm resistor in secondary return circuits of first or second r-f transformers
	2)	open-circuited or burnt-out speaker field
Intermittent reception, Fading	1)	open-circuiting or leaky 0.2-mfd. r-f secondary return by-pass condensers
	2)	open-circuiting screen by-pass condenser
	3)	leaky r-f plate circuit by-pass condenser
	4)	"shorted" or broken phono switch controlled by tuning condenser
Fading	1)	loose elements in type '24 tubes. Replace by substituting new tubes
	2)	intermittently open-circuiting primary in the first audio transformer. Replace with new transformer
Whistling or squealing	1)	open-circuited 50,000-ohm section of voltage divider
	2)	open-circuited 0.5-mfd. screen by-pass condenser
	3)	open-circuited 0.2-mfd. plate circuit by-pass condenser
	4)	open-circuited 0.2-mfd. first r-f, second r-f, or detector secondary-return by-pass condensers
Distortion, No output tube grid bias	1)	open-circuited 100,000-ohm resistor in push-pull input transformer secondary return circuit
No control of volume	1)	cable of volume control shaft off pulley
	2)	volume control shaft pulley loose

COLONIAL 34

(See also Case Histories listed for Colonial 33 receiver)

Inoperative	1)	open-circuit in one of the sections of the 121,000-ohm voltage divider resistor. Check each section carefully, replacing if defective
	2)	open-circuited 420-ohm center-tapped resistor (usually at the negative end) connected in the negative leg of the power supply, located between the two type '45 sockets. This may be short-circuited temporarily, but a replacement is advisable
Low volume at high-frequencies (tubes and voltages test O.K.)	1)	open-circuit in one of the small bobbin coils used to couple the tuning unit more effectively. These are located in the antenna and first r-f units of the band-pass filter. Defect is usually at the lug
Whistling or squealing	1)	short-circuited section of voltage-divider resistor. Replace with new unit
Slight whistling, (poor reception on the lower frequencies)	1)	open-circuit in one of the 0.2-mfd. condensers located under the condenser gang shield and used as secondary return by-pass units. One terminal is soldered to each coil. Replace with new units if found defective
Whistling (r-f screen and plate voltages high)	1)	open-circuited 50,000-ohm center section of voltage divider
Distortion, Lack of grid-bias on the type '45 amplifier tubes	1)	open-circuited grid-bias resistor — a 10,000-ohm carbon unit connected from the secondary center-tap of the input push-pull transformer to chassis. Replace with new unit

COLONIAL 35 A.C.

Inoperative between about 500 to 550 kc.	1)	dial "shorts" out phono switch. Loosen the nuts which hold the switch, push it further back, and tighten the nuts

COLONIAL 36 A.C.

Intermittent reception	1)	leaky 0.25-mfd. by-pass condensers. Replace if defective
	2)	defective 0.5-mfd. condenser between the first audio transformer and cathode. Replace with a new unit
	3)	defective tube sockets, resulting in poor contact at tube base prongs. Clean and bend contacts or replace with new sockets
	4)	faulty 0.1-mfd. coupling condenser between the detector and power stage. Replace
	5)	defective phonograph switch. Replace with a new switch
	6)	high-resistance grounds at r-f shields. Bond together all the grounding lugs with a piece of bus-bar and solder the latter in turn, securely to the chassis
	7)	faulty 100,000-ohm r-f screen-grid bleeder resistor. May also cause fading and loss of volume
Insensitive	1)	open-circuited antenna winding in the first r-f coil
	2)	loose connection at the antenna-end terminal of the first r-f coil
Excessive hum	1)	open-circuit or increase in value in the 400,000-ohm resistors connected between the grids of the type '45 push-pull tubes and the hum-balancing potentiometer. Replace the dual unit with single ½-watt resistor

(Cont'd)

COLONIAL 36 A.C.—*(Cont'd)*

800-ohm bias resistor overheats	1)	faulty 0.1-mfd. coupling condensers between the detector and power stage
	2)	check for a "short" between the 2.5-volt filament winding for the '45 tubes and that for the '80 tube
	3)	make sure the grid returns of the power tubes are not "open"
Low volume, Distortion, Inoperative	1)	replace the 350-ohm bias resistor connected between the chassis and first and second r-f tube cathodes, with a 1-watt carbon unit
	2)	replace the two 400,000-ohm grid leaks in the output tube grid circuits
	3)	replace the 60,000- and 100,000-ohm voltage-divider resistors.
Distortion (low voltages on all tubes, abnormal plate current on 45's)	1)	"leaky" coupling condensers to the '45 grids
Distortion at all but low volume (high voltages on all tubes)	1)	"open" leld coil (the field is used as a bleeder in this receiver)

COLONIAL 36-P

Intermittent reception, Fading, Loss of volume	1)	faulty 100,000-ohm bleeder resistor between r-f screens and ground. Install new one

COLONIAL 37, 37-P

Inoperative, Weak reception, Distortion, Instability and whistling	1)	"leaky" or "shorted" by-pass condensers

COLONIAL 41

Hum	1)	if ordinary causes of hum are not responsible, check the hum-bucking coil located in the detector circuit between the cathode and a 0.5-mfd. condenser (the other side of this condenser being grounded). If this condenser is faulty, the control-grid bias on the detector will be low and a hum will appear

COLONIAL 62

Inoperative, Inoperative over part of dial	1)	56 oscillator tube not oscillating properly. If replacing tube does not help, check 30,000-ohm grid resistor and 0.00025-mfd. grid condenser for this tube. Replace if values have changed
Poor tone quality, Distortion	1)	check for leakage in 8-mfd. input filter condenser going to speaker field

COLONIAL 85

Inoperative	1)	remove speaker plug from chassis and test for continuity between the two smaller prongs. These go to the primary winding of the output transformer which is subject to burnout due to the heavy plate current of the parallel 47's

COLONIAL 136

Type '25Z5 tube flashes	1)	defective electrolytic condenser in power supply unit. Replace with a 225- or 250-volt unit
	2)	replace the 0.02-mfd. condenser across the plates of the type '25Z5 tube with a 400-volt unit
	3)	check the antenna series condenser. Connect a 0.001-mfd. unit in the circuit if one is not there

COLONIAL 250

Inoperative	1)	defective heater cord
	2)	defective type '25Z5 tube
Hum	1)	adjust speaker and grid leads
No AVC action	1)	open-circuit or change in value of AVC resistor connected in the circuit of the type '6B7 AVC tube. Replace with new unit

COLONIAL 300

Poor tone	1)	defective condenser bank. Replace
Inoperative	1)	replace dual 4-mfd. filter condenser

COLONIAL 600A

Intermittent reception	1)	replace the solid grid lead of the 6A7 with flexible wire

COLONIAL 601

Type '83 rectifier tube flashes	1)	short-circuited electrolytic filter condenser. Replace with new unit
	2)	overloading of rectifier tube
Distortion	1)	defective type '37 tube (even though it may test O.K.). Replace with new tube
	2)	defective type '37 tube resistor. Check all resistors in this circuit for changes in value

COLONIAL 605

Inoperative	1)	check for "short" in 0.1-mfd. 78 first detector plate supply by-pass condenser. Replace with 400-volt unit. Also install new 5,000-ohm resistor in same circuit

COLONIAL 654

No control of volume on local stations	1)	connect a lead from the unused lug of the volume control to the point where the 0.001-mfd. condenser is connected to the antenna coil primary

COLONIAL 656

"Hiss" on all stations except strong locals	1)	poor contact at rotor wiper springs. Clean and bend for better contact. Realign receiver (i-f 480 kc)

COLONIAL 995-C

Installing interstation noise suppression	1)	a hi-lo sensitivity switch which will cut down interstation noise when tuning locals may be installed on this model as follows: (*a*) remove wire lead between lugs 1 and 2 of the Candohm resistors (*b*) connect a 100-ohm resistor across these lugs (*c*) detach ground connection from lug 1 (*d*) attach ground connection to lug 2 (*e*) drill a hole in the right side of the cabinet to receive a single-pole single-throw switch (*f*) connect the switch terminals across the 100-ohm resistor

---

COLUMBIA

(Columbia Phonograph Co.)

COLUMBIA C-2

Intermittent "frying" noises	1)	check all r-f coils for faulty insulation between primary and secondary windings. Check for the slightest leakage as well as for outright "shorts"

COLUMBIA C-31

See Case History listed under Brunswick 10-AC receiver, and those for TCA chassis

COLUMBIA C-80A

Distortion	1)	check audio coupling condenser (enclosed in condenser case mounted above chassis) for leakage
	2)	check 300,000-ohm grid coupling condenser of 47 tube for change in value

COLUMBIA C-100A

Cuts off during the passage of strong signals, Intermittent reception (voltage drops across power supply and at plate of the power pentode)	1)	defective type '47 tube (even though it may test O.K.). The insulation in this tube breaks down on strong signals, causing the cut-off. Replace with new tube

COLUMBIA C-101

Distortion	1)	replace 40,000-ohm 1-watt resistor in cathode circuit of detector (located under a triple bank of coils). This unit changes to high value

COLUMBIA 205, 310

Same Case Histories as those listed for Kolster K-20 receiver

COLUMBIA C-800A

Whistling or squealing	1)	check for poor contact between base prongs and spray shield on tubes

---

COLUMBIA

(Columbia Radio Corp.)

COLUMBIA SCREEN-GRID 8

Inoperative	1)	open-circuited detector choke
	2)	short-circuited condenser in detector choke and condenser assembly
	3)	open plate choke in one of r-f circuits
	4)	short-circuited r-f coupling condenser
Inoperative, Hum	1)	rubber grommet on pilot light assembly may be defective, allowing either side of the pilot light circuit to become grounded. This may cause the power transformer to become damaged, the 300-ohm centertapped resistor to burn out, or a strong a.c. hum to appear
Intermittent reception	1)	"break" in fine wires of volume control
	2)	poor contact between slider arm and resistance element of volume control
Intermittent reception, Fading, Crackling	1)	"open" r-f choke in the first r-f stage. It is well to check all the chokes, and their lugs and connections to them, as an "open" in the winding, or in one of the connections will cause one of these troubles
Fading	1)	check the 0.1-mfd. coupling condenser between the detector and first a-f tube
	2)	check for faulty r-f by-pass condensers
	3)	check for poorly soldered connections
Whistling or squealing	1)	check the 0.88-mfd. cathode by-pass condenser for an "open" or "shorted" condition. Test it for an "open" by shunting it with a 1-mfd. condenser. An ordinary 1-mfd. condenser may be used for replacement
	2)	"open" screen-grid by-pass condenser
	3)	realign tuning circuits

(Cont'd over)

COLUMBIA SCREEN-GRID 8—(*Cont'd*)

Whistling or squealing —(*Cont'd*)	4)	if receiver oscillates only when volume control is advanced, insert a 5,000-ohm resistor in the grid circuit of the detector
Loss of volume over a period of time	1)	loose rotor section on the condenser gang. Drill and tap the condenser gang hub for a set screw, in order to hold the rotor section in place

COLUMBIA SCREEN-GRID 9

Inoperative	1)	"open" 1,500-ohm section of "Candohm" resistor
Weak reception, Frying noise, Distortion	1)	detector plate choke open-circuiting. Replace with new unit
	2)	"leaky" condenser connected from screen-grid of the fourth '24 r-f tube to the common cathode-return lead (this condenser and another are connected inside the condenser can)

CONTINENTAL

CONTINENTAL Z4, Z5 (CHASSIS)

Inoperative	1)	check connections from battery cable to storage battery. If connections are reversed, set will not operate
	2)	check all tubes
	3)	check tube shields for good "ground" connections. Check grid caps for good connection. See that grid caps and tube shields are not "shorted" to each other
	4)	reversed connections on Antenna and Ground terminals. Try both ways
	5)	vibrator unit not securely in socket
	6)	'1C6 oscillator tube not oscillating. To ascertain whether it is oscillating, check the oscillator plate voltage. If this is O.K., ground the oscillator grid of the '1C6 tube ("short" the stator plates to the rotor plates on oscillator section of the gang condenser). If the tube is oscillating properly, grounding this grid will cause an appreciable drop in oscillator voltage—otherwise it will not
Hum (excessive)	1)	a poor ground connection, or no ground at all being used on receiver
	2)	vibrator unit not securely in socket
	3)	antenna picking up interference from high-tension power lines
	4)	weak or rundown batt. Defective cell
	5)	poor battery connections
	6)	extending or lengthening battery leads causes enormous increase in "hum". The battery cable attached to the receiver is of special design and its ends *must* be connected directly to battery posts
Howling, Squealing	1)	poor ground connections—or no ground being used on receiver
	2)	speaker leads placed near the '32 tube. These leads should be kept away from this locality by running them along end of chassis and front corner of cabinet
	3)	check the '34 tube shield for good connection to chassis
Microphonic noises, Howling	1)	loosen the four mounting screws that secure the chassis to the cabinet, and remove the two wooden strips that are underneath the chassis. This allows the chassis to "float" and rest on the four rubber pads used for this purpose. After the strips have been removed, adjust the chassis in the cabinet so that the dial will be in the center of the front escutcheon plate. Do not retighten the mounting screws

CORONADO

CORONADO Auto Radio

Buzzing, Crackling	1)	replace buffer condenser with new 0.01-mfd.. 1600-volt unit soldered across plate terminals of 84 tube
	2)	"open" grid-return filter in output tube circuit. Connect a 0.25-mfd. by-pass condenser between ground and junction of two grid resistors
"Roaring" noise	1)	"open" 0.1-mfd. i-f cathode by-pass condenser

CORONADO 6B (6-volt Power Converter Unit)

Inoperative	1)	storage battery run down
	2)	battery connections "loose"
	3)	relay not closing—heavy *red* or *black* battery wires may be twisted inside the unit, holding the relay armature open
	4)	fuse blown—check all wiring before inserting a new fuse. Also check the vibrator. A good vibrator will have a smooth hum when holding your ear close to it; a worn vibrator will "sputter"
R-f "hash" noise in receiver, usually a frying-buzzing sound	1)	a good antenna and ground *must* be used on the receiver
	2)	power unit should be located away from the set by the length of the cable
	3)	on sets having short-wave bands, noise may always be noticed on some parts of the band but is usually not objectionable
High battery drain (batteries run down too frequently)	1)	the total drain on the six-volt battery should be approximately *one* ampere plus the normal "*A*" drain of the receiver. Excessive drain may be caused by a faulty transformer, vibrator or filter condenser in the power unit, or a faulty switch or by-pass cond. in the set

CORONADO 11-B

Intermittent reception, Noisy reception	1)	check all tubes
	2)	intermittent "open" in coupling cond.
	3)	corroded socket or tube pin contacts
	4)	speaker voice coil out of center
Weak reception	1)	check tubes
	2)	check antenna and ground connections for poor contacts
	3)	faulty by-pass condenser
	4)	faulty filter condenser
	5)	faulty loudspeaker
	6)	receiver out of alignment (465 kc i-f)
Poor selectivity	1)	receiver is naturally "broad" in the high-fidelity position, but should be very selective in "normal" tone position—if it is not, check i-f alignment (456 kc)
Distortion	1)	speaker voice coil out of center
	2)	check tubes carefully, especially the 6C5, 6F5 and 6L6 types
	3)	r-f or i-f stages overloaded due to "short" or "open" in AVC line
Hum	1)	abnormally high line voltage
	2)	faulty filter condenser
	3)	speaker field "shorted'
	4)	faulty tubes—check the 6C5, 6F5, 6L6 or 5Y3 tubes carefully
	5)	change 100,000-ohm resistor (connected between main $B+$ line and the resistor that connects to the plate of the 6C5 first audio (inverter) tube) to 50,000 ohms. Also disconnect the end of the 250,000-ohm detector plate resistor which now connects to the main $B+$ line.

(Cont'd)

CORONADO 11-B—*(Cont'd)*

Hum —*(Cont'd)*		Connect this end of the resistor to the junction of the 25,000-ohm inverter tube plate resistor and the 50,000-ohm resistor you just installed
Motorboating	1) 2)	faulty 6L6 tube "open" coupling condenser
Tuning belt slipping	1) 2) 3) 4) 5)	idler spring too loose belt worn or stretched condenser thrust bearing too tight, or not lubricated faulty gear on condenser if belt slips only slightly, apply a small amount of "belt dressing" or rosin it

CORONADO 410-B

Weak reception (tubes, batts., etc. O.K.)	1)	check alignment of oscillator. (The i-f of this receiver is 456 kc)

CORONADO 540

See also Case Histories listed for Coronado 650, 850 receivers

Rattle, distortion	1)	this model is equipped with a balanced armature type magnetic speaker. If rattling occurs proceed as follows: (*a*) *"Quam" type speaker*: bend bracket holding armature snubber cup up or down until armature "centers". This bracket is located on bottom of magnet housing (*b*) *Wright De Coster type speaker*: to center the armature, remove the small aluminum plate on bottom of the magnet housing, loosen one of the small set screws and tighten the other until the armature is "floating" in the center between the poles

CORONADO 550

Whistling	1)	'34 tube shield makes poor contact with ground clip. Bend the clip to make better contact with the shield

CORONADO 575

Fading	1)	poor "ground" on the battery switch—due to grounding wire working loose. This runs from the switch to one of the i-f can lugs. A permanent cure for this trouble lies in grounding the switch shaft with a pigtail lead

CORONADO 650

See also Case Histories listed for Coronado 850 receiver

Intermittent reception	1)	one or both of the switches on volume control faulty

CORONADO 650-A, 650-B

Whistling (especially around 550-650 kc. region)	1) 2)	connect a 0.02-mfd. 600-volt condenser from the plate of one of the 950 tubes to ground check alignment of i-f stages

CORONADO MODEL 810

Same Case Histories as those listed for Coronado 11B receiver

CORONADO 850, 850B (Battery Operated)

Intermittent reception	1) 2) 3) 4)	check all tubes intermittent "open" in coupling condensers, coil terminals or switch contacts loose connection in any of the wiring including antenna and ground lead-in corroded socket or tube-pin contacts
Weak reception	1) 2) 3) 4) 5) 6)	check all tubes check batteries check antenna or ground connections "shorted" lightning arrester check resistors, coils, a-f transformer, condensers and loudspeaker check alignment of receiver
Poor selectivity	1) 2)	i-f amplifier out of alignment antenna too long
Distortion	1) 2) 3) 4) 5) 6) 7)	speaker voice coil out of center check tubes—especially the '30 and 950 tubes AVC line "shorted" or "open"—evidenced by overloading of i-f or r-f stages on strong signals one side of a-f transformer "open" faulty output transformer on loudspeaker "shorted" or "open" condenser in audio circuit "shorted" or open resistor in audio circuit
Excessive battery drain, Batteries run down too frequently	1)	check the "A" drain with a meter—it should not be over 0.68 amp. The "B" drain should also be checked—it should not be over 20 to 22 milliamperes on "low" volume. Excessive drain may usually be traced to "shorted" or "leaky" condensers, or a defective switch or tubes
Tuning belt slips	1) 2) 3) 4) 5) 6)	idler spring too loose belt worn or stretched condenser thrust bearing too tight, or not lubricated faulty gear on condenser if belt slips only slightly, apply a small amount of "belt dressing" or powdered rosin, to it in the Model 650 receiver the idler tension may be increased by forming the long end of the spring so that greater tension will be placed on the lever. Should the belt tend to slip "off" the large pulley, it is an indication that the pulleys are not in line. The set-screw in the hub of the large pulley may be loosened, and the pulley moved on the shaft until it is in line with the lower pulley
Code interference (model 650 receiver)	1)	all late productions of this model (had letter "T" marked on back of chassis and on carton) are equipped with a wave-trap *No. 17736* to eliminate this trouble. This same wave-trap may be connected (with its coil end to the ant. terminal of the receiver and its condenser end to the ground terminal of the receiver) to all receivers not bearing this mark "T". After installation, it must be tuned to *minimum* response to a 456-kc signal applied to the antenna lead (or to *minimum* reception of the code interference)

CORONADO 864 (Series A12)

Distortion ——1) check to see if center-tap of output transformer has been connected to wrong point at speaker plug at factory. The center-tap should be connected to the 250-volt terminal of the speaker plug

CORONADO 7700

Distortion ——1) defective speaker
2) defective input transformer. Replace with new unit

COURIER

(See Case History listings under PEERLESS)

CRANE

CRANE 5

Intermittent reception, Distortion ——1) check the value of the 50,000-ohm ½-watt resistor in the first a-f and output stage. If far off value, replace with 50,000-ohm 2-watt resistor

Noisy ——1) replace volume control

CROSLEY

(See also "De FOREST CROSLEY" receivers)

CROSLEY RECEIVERS—General Service Notes

Speaker rattling ——1) remove speaker diaphragm assembly and dip the voice coil in thinned shellac or varnish (should be very thin for good penetration). Allow to harden, and repeat for a second coat

Repairing "Musicones" and "Dynacones" (types A to F inclusive) ——1) if cone is crushed, iron out the crushed cone with an ordinary hot flat-iron. Iron out only a small portion of the cone at a time, pivoting the point of the iron at the cone vertex. Place a resiliant newspaper or magazine under the cone while ironing out. Straighten out the armature, apply a drop of oil to the adjusting screw. Center the armature accurately, (screw *in* until the cone rasps or rattles, then screw *out* until it rattles again . . . count the number of turns between these two points, and screw in exactly half that number of turns)

Slipping of dial on lower-priced models employing a friction drive spring held up by a washer ——1) remove the dial. Knock washer off the shaft and remove the spring together with the back piece of brass. If a shoulder has worn into the brass piece, file or grind it off, replace and rehead the washer into the shaft. If you cannot get the washer to stay on the shaft, push it down tight on the spring and solder it in place. If it is difficult to remove the spring and brass piece, take the friction part and fit a piece of stove pipe wire into the slot into which the dial edge fits. It should be cut to fit snugly and be forced in tightly

Hum in certain Mershon condenser models ——1) if it is desired to save the cost of a replacement electrolytic condenser, first discharge the condenser by shorting it with a wire Drill a ¼-inch hole in the bakelite top of the electrolytic unit, being careful not to damage the "insides." Fill with distilled water to a point about ¼ inch from the top, and close up the hole with sealing wax

(Cont'd)

CROSLEY RECEIVERS—General Service Notes—*(Cont'd)*

Hum ——1) "shorting" of the filament center-tapped resistors (which are arranged in tiers). Buckling of the strips upon which the resistors are wound will cause this trouble. Use 20-ohm replacement units

Inoperative (early receivers) ——1) if blue haze appears in rectifier tube and all plate voltages are low, look for "shorted" r-f by-pass condenser
2) examine to see if receiver has fuses connected in series with the primary. If fuse is blown, first check to see what caused the overload. Look for "shorts" and "grounds" in the B-plus circuits. Test the electrolytic condensers—possibly by substituting another electrolytic unit. Sometimes corrosion develops between the condenser terminals, resulting in excessive leakage. Remove this corrosion with a stiff wire brush, or scrape it away. After cause of trouble has been located, install new fuses

Volume poor ——1) in the receivers which use an autodyne first-detector circuit, volume is often poor at certain portions of the dial. If it persists after the tuning condenser tracking has been checked, try another '24 tube in the det.-osc. socket. As this tube is "fussy" several may have to be tried before a suitable one is found

Noisy volume controls ——1) noises often develop in those receivers using carbon-strip controls. Replace with wire-wound units

1933 CROSLEY RECEIVERS

Inoperative after about ½ hour of operation, (tubes and voltages check O.K.) 1) i-f transformer damaged because of its close proximity to the heat from the tubes in the receiver. Replace with new unit

CROSLEY "BAND-BOX"

See Case History listings under Crosley 601 "Band-Box" receiver

CROSLEY "BUDDY", "CHUM"

Inoperative ——1) open-circuited 10,000-ohm screen-grid circuit voltage-dropping resistor (wire-wound). Replace with a carbon unit even though the above resistor may test O.K.

Inoperative over part of band ——1) failure of 24A dynatron oscillator to function over complete band due to critical screen grid and plate operating voltage requirements. Shunt a 1,000-ohm resistor across the bleeder section which supplies the screen grid voltages

Hum (in "Chum" receiver) ——1) check the electrolytic condensers for excessive leakage. A quick method is to do this by substitution

CROSLEY "CHIEF"

(See Crosley 132 "Chief" receiver)

CROSLEY "FIVER"

See also Case Histories listed for Crosley 515 receiver

Volume control inoperative 1) replace defective 5,000-ohm volume control resistor

(Cont'd)

CROSLEY "FIVER"—*(Cont'd)*

Intermittent reception, Erratic oscillator operation	1)	a 2.5-volt pilot light has been installed in the receiver instead of a 6.3-volt bulb, resulting in reduced heater drain and a rise in voltage
Noisy when jarred	1)	poor ground connections on the tuning condenser rotor. Ground with a small piece of flexible braid

CROSLEY "GEMBOX"

(See Crosley 608 and 610 "Gembox" receivers)

CROSLEY "GEMCHEST"

(See Crosley 609 "Gemchest" receiver)

CROSLEY "JEWELBOX"

(See Crosley 804 "Jewelbox" receiver)

CROSLEY "ROAMIO"

Insensitive over most of dial	1)	examine small choke-type first detector, antenna, and grid coils for reversal

CROSLEY "SHOWBOX"

(See Crosley 706 "Showbox" receiver)

CROSLEY "TOTEM"

Smoking, odor	1)	heat developed by filament resistor melts insulating compound in filter condenser. Re-mount the resistor and the plate choke so this will not happen

CROSLEY "WASHINGTON"

Inoperative, No voltage on r-f tubes	1)	volume control burnt out. Replace with new unit
	2)	r-f voltage resistor burnt out

CROSLEY D-5

Inoperative	1)	defective electrolytic filter condenser in power pack
Noisy reception	1)	defective type '42 tube

CROSLEY 5M3

Inoperative	1)	"shorted" section of electrolytic condenser in can above chassis

CROSLEY 6H2

Cuts out on weak stations	1)	"open" lower section of 25,000-ohm bleeder resistor

CROSLEY 7

High-frequency audio response "poor"	1)	on No. 7 receiver, clip the tinned bare wire which goes from the end of the condenser nearest the tone-control to the plate of the '2A5 tube. On the No. 10 receiver clip the tinned wire coming out of the end of the condenser nearest the tone control
Hissing (tube hiss)	1)	connect a 2- or 3-meg. resistor in series with the screen of the '58 first detector tube. By-pass this with a 0.01-mfd. 400-volt condenser

CROSLEY 7H2

Poor reception, Volume control does not operate properly	1)	"open" 11,000-ohm section in Candohm resistor (the section connected from screens to ground)

CROSLEY 7H3

"Put-put" (motorboating) sound	1)	high-resistance ground connection in the shielded wire going to the grid cap of the 6B7 tube

CROSLEY 8H1

Inoperative, Intermittent reception	1)	plates of balancing condensers located on top of i-f coil cans "short" to mounting screws or pillars when they are moved out of their original position
Excessive "hiss" between stations	1)	replace small, flexible 500-ohm '6F7 tube cathode resistor with a 250-ohm unit. Also shunt a 2,000-ohm resistor across the cathode bias resistor of the type '6D6 tube nearest the power transformer

CROSLEY 10

Same Case History as that listed for Crosley 7

CROSLEY 27, 28

Inoperative, Weak, Intermittent operation	1)	faulty 1-mfd. by-pass condenser connected between the screen-grid of the '32 detector and ground. It is in a can holding two condensers, with two terminals exposed and the common one "grounded"

CROSLEY 30-S

See also Case Histories listed for Crosley 31-S, 33-S, 34-S

Volume cannot be cut way down when replacement vol. control is installed	1)	short-circuit the 3,500-ohm resistor (which is in series with this control) completely out of the circuit
Noisy, Unstable	1)	if detector plate current is above normal, check the 0.05-mfd. condenser by-passing the det. cathode-bias resistor
	2)	check the 55,000-ohm detector plate resistor for drop in value
	3)	check the mica 0.001-mfd. det. plate by-pass condenser
	4)	check the 0.5-mfd. audio coupling condenser
	5)	check the two paralleled 11,000-ohm stabilizing resistors between the first audio plate feeder and ground
	6)	if rectifier plate current is very high, check the electrolytic filter condenser and replace any units found faulty

CROSLEY 31-S, 33-S, 34-S

Inoperative	1)	terminals of tube sockets short-circuiting to chassis, as holes admitting them are too small for safety. Enlarge the holes
Hum	1)	leaky electrolytic condensers. Replace
Low volume, Lack of sensitivity	1)	decrease in value of 11,000-ohm resistors connected in parallel in the bleeder circuit. Replace with 5-watt units
	2)	check each electrolytic condenser and replace all units drawing more than 5 ma.
	3)	check the tuning condenser bearing for excessive wear. Make sure that the condenser plates are well centered. Wear in the bearings may be compensated for somewhat by installing a pig-tail from each rotor to chassis
	4)	replace the coupling condenser between detector and first audio tube
Low volume, Poor tone	1)	connect a 15,000-ohm resistor between the positive side of the 55,000-ohm detector plate resistor and ground
	2)	try several tubes in the detector stage, as a tube with the proper characteristics is essential for best results

(Cont'd over)

CROSLEY 31-S, 33-S, 34-S—*(Cont'd)*

Inoperative, Intermittent reception	1)	check socket prongs for "shorts" to chassis. As the chassis socket holes are sometimes to small to clear the socket prongs, the prongs often short to the chassis. This is a common trouble which should always be checked before making an analysis on these receivers

CROSLEY 40-S

See also the Case Histories listed under Crosley 41-S receiver

Intermittent operation	1)	loosened rivets on the bias resistor for the screen-grid tubes. Solder each end to the supporting rivet. Frequently, it is necessary to unwind one or two turns of the resistance wire to make proper connections
Distortion, Low volume	1)	if analyzer check shows a positive bias on the first audio tube together with excessive plate circuit, replace the 0.5-mfd. coupling condenser connected between the detector and the first audio grid
Distortion after a few minutes of operation	1)	defective 750-ohm resistor on the resistor strip causing improper bias on the type '45 tubes. The defect is apparent only when the receiver heats up
Excessive hum, (hum disappears when set is removed from cabinet)	1)	condenser block punched by one of the screws which hold the chassis to the cabinet, thereby short-circuiting the condenser. When screw is removed, the hum ceases, since the condenser is no longer short-circuited

CROSLEY 41-S

Intermittent reception	1)	defective 0.5-mfd. r-f cathode by-pass condenser. Replace with new unit
	2)	defective coupling condenser between the plate of type '27 detector tube and the control-grid of the first a-f tube. Replace with new unit
	3)	broken solid-wire leads running from the voice coil to the connecting lugs. Replace with flexible leads
Low volume, Noisy reception	1)	high-resistance connection between the tuning condenser rotor and the frame. Solder flexible pigtails from the rotor shaft to the frame
"Noisy" and "distortion" at high volume	1)	replace the 440-ohm resistor under the chassis
	2)	check the first r-f coil for an intermittent "short"
Poor tone (positive bias on first a-f tube)	1)	replace the by-pass condenser connected between the detector and first audio grid

CROSLEY 42 (Using 45-mil. "Dynacoil" Speaker)

Low volume, Poor sensitivity	1)	change in value of large 6,000-ohm carbon resistor. Replace with 6,000-ohm 10-watt wire-wound unit

CROSLEY 42, 42A

No reception; (no r-f plate voltage)	1)	short-circuited r-f by-pass condenser
	2)	open-circuited 1,400-ohm r-f resistor
Fading	1)	clean volume control contacts and strip
Poor quality, Low volume	1)	replace the coupling condenser between the detector plate and first-audio grid—even if it tests O.K.

(Cont'd)

CROSLEY 42, 42A—*(Cont'd)*

Hum	1)	defective Mershon condenser
Whistling or squealing	1)	readjust balancing condensers
Irregular noises when tuning	1)	clean variable condenser plates and solder a pigtail lead from rotor to chassis

CROSLEY 42-S

See also all Case Histories listed for Crosley 40-S receiver

Low volume	1)	check to see if bottom plate of chassis is touching the center terminal of the volume control. Eliminate any such contact
Distortion, Poor tone	1)	low detector tube grid-bias voltage due to leakage between sections of the dual 0.5-mfd. by-pass condenser across the detector and first a-f bias resistors
Tendency to whistle or squeal due to over-sensitivity	1)	5,500-ohm bleeder resistor "open", raising all voltages
Noisy	1)	range switch or sensitivity control noisy. Solder a flexible pigtail from the wiper on the switch to "ground"
Speaker rattle	1)	remove cone from speaker, and glue voice-coil form to cone
Hum	1)	faulty electrolytic condenser in filter circuit—likely one with excessive leakage

CROSLEY 52TA

Intermittent noise, Distortion	1)	inspect for tuning dial face shorting to drive cord pulley. Prevent this contact by cementing some insulating cloth to back of dial face

CROSLEY 53

Inoperative (type '45 tube grid-bias resistor smoking)	1)	defective 0.5-mfd. condenser connected between the speaker voice coil and the type '45 tube grid-bias resistor terminal. Replace with new unit
Noise and distortion	1)	check coupling condenser between detector plate and '45 grid. Replace with a unit that will stand 300 volts
Overheating and smoking	1)	make sure that the 1,650-ohm bias resistor for the '45 tube has not been burned out
	2)	replace the 0.5-mfd. condenser between the speaker voice coil and a terminal of the grid-bias resistor

CROSLEY 54

See also Case Histories listed for Crosley 53 receiver

Inoperative	1)	"open" heavy duty resistor in "B" supply network
Whistling	1)	check for faulty volume control
Intermittent operation,	1)	if accompanied by increased '45 tube plate current and noise, check the 0.1-mfd. detector to power tube coupling condenser; the 1.0-megohm power tube grid leaks; and the 0.5-mfd. condenser connected between the voice coil and centertap of the 2.5-volt filament winding of the '45 tubes. Use 600-volt type condensers for any condenser replacements necessary

(Cont'd)

CROSLEY 54—*(Cont'd)*

Low volume, Noise, Distortion	1)	leaky 0.1-mfd. condenser between the plate of the detector tube and grid of the audio tube. Replace with a new unit if the leakage resistance is more than 50- or 75-megohms
Poor sensitivity	1)	replace the 150,000-ohm detector plate resistor with a 300,000- or 400,000-ohm unit
Audio "howl" (normal operation restored when the analyzer cable is plugged into the circuit), Intermittent whistling when analyzer is plugged into power tube socket (plate voltage decreases and grid-bias increases when this condition occurs)	1) 2)	change in value of the 150,000-ohm coupling resistor connected between the detector plate choke and the audio coupling condenser, and one side of the a-f choke. Replace with new unit change in value of the 1-megohm type '45 tube grid resistor. Replace with new unit
Whistling	1)	check for faulty volume control
Raspy, harsh, fuzzy tone	1)	in models using the Dynacone speaker, harsh, raspy or fuzzy tone is usually due to hardened rubber damping blocks at the ends of the armature in the unit. Replace these with new ones cut from thin, live rubber. Reassemble unit and adjust properly

CROSLEY 57

See also Case Histories listed for Crosley 53 receiver

Noise and distortion	1)	check coupling condenser between detector plate and '45 grid. Replace with a unit that will stand 300 volts

CROSLEY 58

See also Case Histories listed for Crosley 53 receiver

Inoperative	1) 2)	check metal-cased condenser (containing r-f plate screen and cathode by-pass condensers) for "shorts" check both of the Candohm resistors at back of chassis
Inoperative, (switch has to be put off and on a number of times before receiver starts), (tubes and voltages test O.K.) Insertion of the analyzer cable or test prods starts receiver operating	1)	defective detector grid-bias resistor by-pass condenser. It is usually short-circuited, but is cleared up by the least change of voltage. Replace with new unit
Intermittent reception, Noise	1)	solder the loudspeaker plug to its socket connections under the chassis, so the plug will not work loose
Fading	1)	rewire the filament circuits with direct connections instead of leaving one side grounded

(Cont'd)

CROSLEY 58—*(Cont'd)*

Distortion	1) 2)	check the two detector plate-dropping resistors. They should be 25,000 and 150,000 ohms respectively disconnect the detector screen-grid from the r-f screen grids, connecting it to the detector plate in series with a 250,000-ohm resistor and by-passing it to ground with a 0.25-mfd. condenser
Hum, (not traceable to filter trouble)	1)	replace 1-megohm resistor in '47 grid circuit, connecting to high-voltage secondary tap
Improving the receiver	1) 2)	replace the '24 tubes with 58's by installing 6-hole sockets and connecting the suppressors to the cathodes replace the volume control with a 10,000-ohm unit with same connections. If the new volume control has an A.C. line switch, the space left from the original switch may be used to install a tone control

CROSLEY 59

Hum (not traceable to filter trouble)	1)	replace 1-megohm resistor in '47 grid circuit, connecting to high-voltage secondary tap

CROSLEY 72AF

Weak reception, Station interference (oscillator does not track)	1)	mica condenser connected across oscillator trimmer is "open" or making poor contact. Replace it if faulty

CROSLEY 77

Fading (intermittently)	1)	replacement of one or more faulty 0.1-mfd. condensers which couple the r-f coil sections to ground. Check by substitution

CROSLEY 82-S

Same Case Histories as those listed for Crosley 40-S receiver

CROSLEY 84

Same Case Histories as those listed for Crosley 77 receiver

CROSLEY 95 "Roamio" Auto Radio

Insensitive, Failure of tuned stages to track	1) 2)	some of these receivers were assembled with the connections to the antenna coil, grid coils and detector coils reversed. Reverse the connections to these coils one at a time until normal sensitivity is obtained. Then realign the receiver check the tuning condensers for mechanical alignment
Weak reception, Poor tone quality	1)	often caused by speaker field coils being reversed due to the polarity of the car battery. Reverse these leads

CROSLEY 98 "Roamio" Auto Radio

Inoperative	1)	check for faulty tone control. Replace

CROSLEY 102 Auto Radio

Inoperative	1) 2)	excessive current drawn from *A*-battery. Either one or both vibrator condensers "shorted". (These condensers are accessible by removing the side cover of the vibrator housing) metal cover touches terminal of the lead from the i-f tube grid. Bend terminal so it clears the cover

(Cont'd over)

CROSLEY 102 Auto Radio—*(Cont'd)*

Intermittent reception	1)	break in the flexible lead from the r-f transformer to the rubber-mounted gang condenser. The break usually occurs at a point where a soldered connection is made to the condenser
Whistling or squealing	1)	faulty type '6B7 second detector tube, having low emission. Replace with new tube

CROSLEY 103 Auto Radio

Whistling over part of dial	1)	solder ground strap from the gang condenser to the receiver case

CROSLEY 118 "Readio" (Home Facsimile Recorder)

Not printing	1)	power off
	2)	"loose" or "open" connection between receiver and printer
	3)	stylus stuck
Variations in density or blackness of printing	1)	receiver may not have suitable avc circuit capable of keeping the output constant over wide variations of incoming signal strength
	2)	receiver may not have sufficient output
	3)	stylus may be stuck in bakelite bracket
	4)	stylus may be worn
	5)	platen track may have small deposits of carbon on it. (See instruction below for these troubles
Wobbly printing	1)	receiver not tuned properly (printer not synchronized with transmitter)
	2)	bent or loose stylus pin
Stylus arm keeps moving	1)	the stylus arm should come to rest at the left hand side of the paper when the "volume" or "level control" setting is reduced appreciably. If it keeps moving back and forth, the end of the magnetic clutch arm that engages the dog on the clutch plate may be slightly worn. If this is the case, it may be compensated for by a slight adjustment of the magnetic clutch stop screw. Loosen the stop screw lock nut, then turn screw to the left (counter-clockwise) about a quarter turn, or just enough to cause the magnetic clutch arm to engage dog on clutch plate
Stylus binds in bakelite block	1)	small particles of carbon collected on shaft, loosen collar, remove shaft, and clean
Stylus sticks, Printing density varies in shade for each sweep of stylus	1)	platen track (strip of spring steel back of paper gate and platen bar) has collected deposits of carbon. To clean, carefully turn stylus assembly at right angles to stylus arm in order to prevent possible damage to stylus point when removing paper gate. Then push lever back on platen bar and carefully remove platen gate. With very *fine* sand paper using a wiping motion from one side to the other, polish the platen track. Replace paper gate. Replace stylus to printing position
Motor lubrication	1)	each bearing of motor should be oiled with a high grade of light lubricating oil once in every 300 hours of service
Clutch lubrication	1)	clutch should be thoroughly lubricated at all times. Check at least once a week

CROSLEY 120

Noises, but no signals	1)	dynatron oscillator not functioning properly. Shunt a 2,000-ohm resistor across the voltage-divider section which supplies the oscillator plate voltage. Since most

(Cont'd)

CROSLEY 120—*(Cont'd)*

Noises, but no signals *(Cont'd.)*		'24 tubes now available have "treated" (carbon-coated) plates and will not afford circuit oscillation in *dynatron* circuits, it may be difficult to get proper '24 replacement tubes for this important position in the receiver. However a 57 tube can easily be substituted for the '24 by making the proper circuit changes. The tuned circuit need not be disturbed. Apply 90 to 100 volts on the screen grid
Inoperative over lower part of dial only	1)	clean the screw and stationary plate of the padding system used for the low-frequency end of the tuning range and replace. Be sure to clean the screw plate carefully and apply a thin coat of vaseline to each part before replacing to prevent further oxidation
Loud "crackling" (similar to static and a building up of volume—then cutting off sharp and clearing up)	1)	replace the small 0.02-mfd. condenser between the '24 and '27 tubes and under the resistor strip. This unit breaks down quite frequently
Hum (tunable)	1)	try adding a 0.01-mfd. condenser from the a-c plate of the rectifier to the ground
General poor performance	1)	check the tiny resistors used in this receiver for "breakdown." Replace any faulty ones with good grade metalized resistors

CROSLEY 122

Inoperative at low-frequency end of dial (due to failure to dynatron '24 oscillator to function)	1)	shunt a 1-watt, 750-ohm resistor across 650-ohm volume control and replace with type '24A tube (2.5-volt filament)
Weak, erratic reception	1)	"leaky" 0.1-mfd. 35 i-f tube plate circuit by-pass condenser
	2)	faulty 0.1-mfd. 24 oscillator tube plate circuit by-pass condenser. Replace
Distortion at high volume	1)	1,300-ohm wire-wound plate and screen-grid voltage resistor faulty
Improving early production receivers	1)	if the changes which the factory made in the later production of this model are made in the early-production receivers, improved performance will result. These changes are itemized here:
		(*a*) change 60,000-ohm detector plate resistor to 25,000 ohms
		(*b*) shunt a 300,000-ohm resistor across the secondary of the push-pull input transformer
		(*c*) change the 1-meg. pentode grid resistor to 300,000 ohms
		(*d*) change the 2,500-ohm volume control resistor to one of 650 ohms. Eliminate the 1,100-ohm shunting resistor entirely
		(*e*) change the 3,000-ohm oscill. screen resistor to one of 1,790 ohms
		(*f*) change the 25,000-ohm r-f screen-grid resistor to one of 20,000 ohms

CROSLEY 124

Inoperative (all voltages O.K.)	1)	open-circuited 2,000-ohm flexible bias resistor between the cathode of the oscillator tube and ground. Replace with new unit

(Cont'd)

CROSLEY 124—(*Cont'd*)

Intermittent reception, (set resumes normal operation after being inoperative for several hours)	1)	defective "bathtub-type" can-enclosed condenser unit located underneath several other units. Test each section. Replace with new unit if necessary
	2)	replace the 0.1-mfd. r-f screen by-pass condenser
Intermittent reception, Whistling	1)	"open" r-f or i-f cathode bias condenser
Noisy reception, Intermittent reception	1)	defective volume control. Install a new 5,000-ohm unit
Low volume	1)	defective 15,000-ohm r-f and i-f tube screen-grid resistors. Replace with new unit
Fading	1)	defective 4-section 0.1-mfd. condenser block. Usually requires complete replacement (*Part W22412*)
	2)	look for cold-soldered joint on i-f transformer lug
Whistling (sounds like loose voice coil)	1)	move position of type '47 tube grid wires from between socket terminals of the type '27 detector tube and type '51 tube screen terminal to a position near the detector choke
"Rasping" tone, Low frequency howl	1)	distorted voice coil, rubbing against pole pieces. Replace with new coil
High control-grid bias on the r-f and i-f tubes	1)	change in value of grid-bias resistors. Connect a 400- to 750-ohm resistor between the volume control and ground, which will keep the bias under control
General poor performance	1)	check the tiny resistors used in this receiver for "breakdown." Replace any faulty ones with good grade metalized resistors
Speaker "flutter" on strong signals	1)	faulty push-pull input transformer. Substitute another even if the bad one checks O.K. If a hum results when new transf. is installed, it may be due to the position it was mounted in. Try shifting it around

CROSLEY 124-1

Fading, Intermittent reception	1)	high leakage in one of four 0.1-mfd. condensers located in condenser block *No. W22412*
	2)	"leaky" two 0.25-mfd. units and 0.5-mfd. unit in condenser block *No. W23736*
Fading (signal returns to normal volume if set is switched off, and on again—or if tube is pulled and then reinserted)	1)	replace condenser block *No. W22412* which contains the four 0.1-mfd. condensers

CROSLEY 124J

Weak reception, Station interference (impossible to align i-f tuned circuits properly at 175 kc)	1)	grounded or short-circuited winding on first i-f transformer. Replace with new unit
	2)	defective type '27 oscillator tube. Replace with new tube
	3)	check "phasing" of twin speakers

CROSLEY 125

Inoperative (no plate voltage on osc.-det. tube)	1)	inspect mica separators in i-f trimmer condenser for possible "short"
Inoperative below 875 kc	1)	faulty 6,500-ohm resistor across primary of oscillator coil (*LW 24008*). Connect a variable 50,000-ohm resistor across the coil in its place and vary it until best reception is obtained. Check the value of this resistance with an ohmmeter, and substitute a permanent resistor of this value across the coil
Noise when volume is adjusted	1)	due to poor slider-contact on the volume control resistance, or to poor contact between the slider and its bearing. Install a secure pigtail contact between slider arm and center contact, but insulate the pigtail so it will not "short" against the metal case of the volume control. Also wash the entire control with gasoline, alcohol, or Carbona

CROSLEY 126-1

Distortion	1)	defective audio coupling condenser
	2)	speaker out of adjustment

CROSLEY 127

Gradual decrease in sensitivity over period of time	1)	try new set of i-f coils, keeping all connecting leads short
Volume drops suddenly, Tuning meter fails to indicate	1)	partial "short" in the i-f transformers
	2)	screen grids in '47 tube become red hot, causing then to sag and "short" out. Replace the 6,000-ohm 1-watt resistor which feeds the screen grids of these tubes. Use a 6,000-ohm 10-watt unit

CROSLEY 128

Neon pilot light flashes intermittently when set is turned off	1)	if all condensers in set are O.K. but a milliammeter in B+ lead shows an approximate drain of 0.2-ma. when set is turned off, and increases to about 0.3-ma. every 20 seconds or so, at which time the pilot flashes, change the wiring of set as follows: Remove lead from antenna coil to ground on chassis. Run new lead from coil terminal, under coil shield and up to center terminal of volume control. Run new lead from chassis terminal to point on 4-pole, single-throw switch to which the black and yellow or A-2 volt lead is attached. Use well insulated wire. Be sure that volume control is insulated from chassis, as sometimes the fibre washers have been removed. It is sometimes necessary to replace lead from pilot lamp socket to filament prong socket of the '30 oscillator. With this hookup, set and pilot lamp operate normally, but if antenna is grounded or lighting arrester is defective, the pilot lamp will glow continually when the set is turned off and antenna switch is in "distance" position

CROSLEY 129

Whistling at high frequencies (tubes and voltages test O.K.)	1)	change in value of critical 200-ohm fixed portion of volume control. Check its resistance. Replace with a new volume control unit. In some receivers it is necessary to connect a 25-ohm resistor in series with the 200-ohm section (raising the value of this fixed section to 225 ohms) for proper operation

CROSLEY 130

Reception drifts off frequency setting of tuning dial	1)	leaky or open-circuited 8-mfd. 300-volt filter condenser section of dual condenser unit. Replace with new 450-volt unit
	2)	leaky or open-circuited 4-mfd. 150-volt screen-grid condenser section of dual unit. Replace with new 200-volt unit
	3)	adjust the oscillator trimmer condenser
Whistling, Weak reception, Hum	1)	check 4-mfd. 300-volt section of dual cardboard type dry electrolytic condenser. Use a 450-volt unit for replacement

CROSLEY 131

Weak reception,	1)	replace '47 second detector and output tube (even if tube tests O.K. in tube tester)
Noisy reception, Fading	1)	test volume control, and replace if necessary

CROSLEY 132 "CHIEF"

Low volume, (tubes and voltages test O.K.)	1)	short-circuited 0.0001-mfd. condenser between the cathode of the '56 tube used as a diode-detector and the 5-megohm resistor. Check the latter unit for change in value also

CROSLEY 132-1

No AVC action	1)	defective 0.15-megohm resistor (*R-4*). Replace with new unit

CROSLEY 137

Insensitive, No distant reception	1)	defective oscillator coil. Replace with new unit

CROSLEY 143

Little or no reception at high-frequency end of dial, Poor control of volume	1)	replace 300,000-ohm 34 second detector tube plate load resistor with 250,000-ohm unit to increase plate voltage
Distortion	1)	replace coupling condenser in '30 driver tube circuit
	2)	if plate current of '30 driver tube is low, replace 3.0-megohm tone control as it is part of the network which regulates the bias to the driver tube
Neon pilot bulb lights when set switch is in off position	1)	check the 8-mfd. 150-volt condenser for leakage. Replace it if necessary

CROSLEY 146

Insensitive, Weak reception on local stations, No distant reception, (voltages test O.K.)	1)	open-circuited 12-mfd. condenser section of dual 12-6 mfd. cardboard encased filter unit. Replace with a 400-volt unit

CROSLEY 148

Inoperative	1)	charred or open-circuited semi-flexible wire-wound 750-ohm type '42 tube bias resistor. Replace with a new unit. Also check the 8-mfd. 25-volt by-pass condenser shunting this resistor
	2)	short-circuited 6-mfd. 300-volt, and 8-mfd. 25-volt dual electrolytic filter condenser. Replace with new unit
	3)	if all plate voltages are low, check for "short" in first i-f plate trimmer (short usually occurs next to the ground plate of the trimmer). Re-insulate with larger pieces of mica (same thickness)
Inoperative (voltages O.K.)	1)	sometimes due to shorting of the i-f tuning condenser suspended in a square hole cut in the chassis between the '58s. Caused by puncture of the mica spacer when the screw is driven down too tight. Slip a small piece of mica under the hinge part of the condenser plate, and realign. Also check for similar trouble in the other postage-stamp condenser located on top of the chassis
Inoperative, or weak	1)	increase in value of wire-wound impregnated resistor under chassis from i-f coil to plate and cathode of '58. Replace with an 8,500-ohm and 25,000-ohm resistor (both 10-watt types)
Inoperative below 1200 kc, Volume control inoperative past first ½-revolution, Whistling all over dial	1)	faulty 6—8-mfd. electrolytic condenser (even though it may test O.K.). Substitute a unit of higher voltage rating and note result
	2)	replace dual 0.03-mfd. and 0.006-mfd. coupling and detector plate by-pass condenser unit
Intermittent reception, Poor operation on low line-voltage	1)	replace the 2.5-volt pilot light with a 6-volt bulb. The pilot is wired across the 6.3-volt tube filament circuit and often reduces the heater voltage below normal—especially if the line voltage drops
Intermittent reception	1)	dirt in padding condenser causing a high-resistance short-circuit. Clean unit with Carbona
Weak reception	1)	defective tone-control condenser
Whistling or squealing Hum	1)	try a 0.02 mfd. 600-volt condenser from the power transformer side of the a-c switch to ground
Fading	1)	make sure to use 6-8-volt pilot lights, as 2.5-volt pilots will cause fading
Distortion, (high current flow in the plate circuit of the output tube)	1)	grounded speaker winding. Locate and correct the ground"
Volume drops, Intermittent distortion	1)	see if the twin "cub" condenser in the resistance-coupling network between the '57 detector and the '42 output tube is reversed. The 0.03-mfd. signal-coupling condenser should be connected between the '57 plate and the '42 tube control-grid. The 0.0006-mfd. by-passing condenser should be connected between the detector plate and ground. (In some receivers of this model, the latter is a 0.001-mfd. condenser instead of a 0.0006-mfd. unit. Due to wrong markings on some condensers, the latter unit is incorrectly connected between the ground and '42 tube control-grid

(Cont'd)

CROSLEY 148—(*Cont'd*)

Crackling, sputtering	1)	disconnect aerial and ground wires to make certain that noise originates in receiver. If it does, remove tuning condenser from its base, resolder all connections, and place insulating paper between condenser and its base (which is connected to chassis)
Carrier hum (usually in early models)	1)	connect a 0.006 to 0.05-mfd. condenser from the power-transformer side of the a-c switch to "ground" of the chassis —on the outside of the chassis
Low-frequency hum at lower end of dial	1)	realign receiver completely. Melt drop of wax on hex nut of each trimmer to prevent subsequent loosening

CROSLEY 154

Weak on low-frequency end of dial	1)	check for 5-meg. grid leak changing value to about 3,000 ohms after 5 or 10 minutes of set operation
Signals low and spread over the band	1)	first detector-oscillator cathode bias resistor has greatly increased in resistance, putting as much as 50 volts instead of the proper 14 volts on the grid. Replace with resistor of proper value
Distortion (starts after set warms up)	1)	check the 150,000-ohm plate-coupling resistor for excessive change in value
Speaker rattle	1)	remove the nuts and washers between the speaker and baffle. Bolt the speaker tight to the baffle
Volume control burns out	1)	connect a 0.01-mfd. condenser in series with lead running from antenna post to low end of volume control

CROSLEY 156

Will not oscillate regardless of regeneration control or volume control setting	1)	remove the regeneration condenser, bend the plates away from each other

CROSLEY 157

"Put-put" (motorboating) sound	1)	make sure that shield over the '6Q7G tube is making good contact
	2)	check for "open" r-f plate by-pass condenser

CROSLEY 157A

Receiver stops playing when jarred Intermittent reception	1)	faulty contact in 6A8G tube socket. Install new socket

CROSLEY 158

Weak reception	1)	"open" 750-ohm resistor connected from grid of '58 to ground
	2)	falling off in capacity of the electrolytic condensers
Intermittent reception	1)	"open" in the 0.02-mfd. condenser connected from the "high" side of the 3-megohm resistor on the antenna coil to ground
Volume control noisy, Audio instability	1)	replace 3-megohm control with a 1-megohm unit. Replace 0.5-megohm resistor *No. 52* with a 0.1-megohm ¼-watt unit
Tone changes intermittently	1)	tone control condenser faulty. Replace with a 0.005-mfd. condenser across primary of output transf. and a 0.05-mfd. condenser in series with tone control across primary of output transformer

CROSLEY 159

Inoperative	1)	burnt-out resistor in the cathode circuit of the type '43 output tube. Replace with a new unit. Also check the condenser which by-passes this resistor
Whistling or squealing while tuning	1)	faulty 8-mfd. 200-volt condenser (in chassis) connected from B+ to ground
Weak reception, Poor tone	1)	"leaky" 6-mfd. 25-volt by-pass condenser from 43 tube cathode to ground

CROSLEY 160

Weak reception, Poor tone	1)	check the '59 tubes to see if they are matched. If trouble is experienced matching push-pull stage plate currents, connect a 100-ohm ½-watt non-inductive resistor in series with each control-grid —right at the tube sockets
	2)	check oscillator circuit for trouble. The 20,000-ohm cathode ressitor can be replaced with a 5,000-ohm unit for better reception

CROSLEY 163

Low volume (plate voltage of type '77 second detector tube drops to about 5-volts)	1)	open-circuited 3-megohm and 300,000-ohm plate load resistors in the type '77 tube circuit. Replace with new units
Distortion after receiver warms up	1)	if all filter condensers and resistors check O.K., replace 150,000-ohm resistor in cathode circuit of 77 tube with a 100,000-ohm unit

CROSLEY 167

Inoperative	1)	insulate leads to the dial-lamp socket with spaghetti. The original leads often ground to the chassis
	2)	faulty electrolytic filter condenser. Replace with new unit
Inoperative Low-pitched hum	1)	leaky or shorted 6-mfd. 300-v. condenser in the dual electrolytic filter condenser unit. Replace with a W-27488-A condenser (which has a 6-mfd. section with a working voltage of 450 volts)
Inoperative (steady, low-pitched shrill whistle)	1)	replace 0.03-0.006 mfd. dual condenser serving as coupling condenser and detector plate by-pass
Inoperative (voltages O.K.)	1)	see remedy listed for this same trouble in the Crosley 148 receiver
Chassis smokes, Inoperative	1)	short-circuit between the positive terminals of the 6-mfd. condenser connected between the output transformer primary and ground and the 8-mfd. condenser connected between the cathode and ground. This places a heavy load on the 750-ohm flexible resistor connected between cathode and ground causing it to burn out. Replace the resistor and the condenser units
Weak or intermittent reception on low frequencies	1)	"leaky" or short-circuited 0.1-mfd. condenser across 3,500-ohm resistor in the cathode circuit of the type '58 first detector-oscillator tube
Fading	1)	make sure to use 6-8-volt pilot lights as 2.5-volt pilots will cause fading

(Cont'd over)

CROSLEY 167—(*Cont'd*)

Distortion, Low volume	1)	leakage between filter condensers and the type '2A5 tube cathode by-pass condenser section. Both of these units are contained in a common can
Whistling all over dial when volume is turned on full	1)	"open" or "lowered value" electrolytic filter block on underside of chassis directly beneath power transformer. To locate the faulty unit, shunt an 8-mfd. high-voltage test condenser across one at a time
	2)	try a 0.02-mfd. 600-volt condenser from power-transformer side of line-switch to ground

CROSLEY 168

Inoperative	1)	"open" section in filter condensers *No. 23-24*
Hiss in background on all stations, even when correctly tuned Lack of AVC	1)	replace the dual 8-mfd. 25-v. condensers in the cathode circuit of the second detector and output tubes, with 75-v. units
	2)	try several 2A6's, 56's and 2A5's. If this does not help, connect from 400,000 to 100,000 ohms across the primary of the first i-f transformer (use the highest permissible value)
	3)	remove the 300,000-ohm ½-watt resistor between the i-f trimmer and the 8-mfd. cathode biasing resistor. Insert a 100,000-ohm 1-watt resistor from the i-f trimmer directly to ground
Hum on strong stations	1)	install a 0.1-mfd. condenser between chassis and one side of a-c line

CROSLEY 169

Inoperative (voltages O.K.)	1)	see remedy listed for this same trouble in the Crosley 148 receiver
Inoperative (steady low-pitched shrill whistle)	1)	replace 0.03-0.006 mfd. dual condenser serving as coupling condenser and detector plate by-pass
Fading	1)	make sure to use 6-8-volt pilot lights, as 2.5-volt pilots will cause fading
Whistling or squealing	1)	connect a 0.02-mfd. 600-volt condenser from power-transformer side of line-switch to ground

CROSLEY 170 DUAL TEN

See also Case Histories listed for Crosley 171

Intermittent reception (noisy and squealing when reception stops)	1)	faulty 8-mfd. condenser across the 25,000-ohm bleeder resistor. This condenser is one of a 3-unit condenser
'80 rectifier burns out repeatedly	1)	electrolytic 8-mfd. condenser (*Part 29097*) "shorts" and then "heals" itself. Replace it with improved condenser *29097-A*
Weak reception (tubes and voltages check O.K.) Poor tone	1)	check grid cap lead to first r-f '58 tube for a break inside the tape
	2)	tone and volume can be improved by connecting a 2- to 4-mfd. by-pass condenser across the first a-f bias resistor. Also, reduce the value of the diode load resistor from 500,000 ohms to 400,000 or 350,000 ohms—whichever gives best results
Weak, noisy, reception	1)	check the 0.0005mfd. tubular condenser in series with the antenna coil

(Cont'd)

CROSLEY 170 Dual Ten—(*Cont'd*)

Whistling (ceases when the finger is placed on the cap of the first type '58 tube)	1)	open-circuited r-f oscillator coil located behind the band switch
Background "hiss" over entire dial	1)	shunt a 300,000-ohm resistor from the primary of the second i-f coil to the chassis
	2)	connect a 2- to 4-mfd. by-pass condenser across the first a-f bias resistor

CROSLEY 171

Inoperative	2)	faulty triple 8-mfd. filter condenser unit (part *No. W-29097*). Replace with the improved part *No. W-29097-A*
	2)	faulty 8,500—25,000-ohm "Candohm" resistor (part *No. W-28471*). Replace with new unit
	3)	faulty rectifier tube as a result of the above condition. Replace with new tube
No QAVC action, Poor volume	1)	faulty section in "Candohm" resistor. Replace with new unit (part *No. 28471*)
Noisy reception, Loss of volume	1)	faulty 0.0005-mfd. tubular condenser in series with antenna coil

CROSLEY 173

Intermittent operation	1)	"open" 16-mfd. section of filter condenser
	2)	if receiver uses tapped primary on power transformer, look for broken wire in tap lead
Weak reception	1)	"open" speaker field
	2)	faulty 8-mfd. 25-volt condenser connected from first a-f 78 suppressor grid to tuning condenser

CROSLEY 175

Inoperative on lower frequencies	1)	replace 7,000-ohm cathode resistor in the oscillator circuit with a 5,000-ohm unit. Realign the i-f amplifier

CROSLEY 178

Tubes burn out when receiver is switched "off"	1)	check to see if 0.1-megohm safety resistor *R1* has been omitted from receiver (see schematic diagram)
	2)	"shorting" 0.5-mfd. condenser *C*, connected between movable arm of volume control and ground. This causes the 22.5-volt "C" battery to be connected across the filaments when the volume control is placed in the "off" position—burning out the tubes
No control of volume	1)	"shorted" condenser from filament of '32 tube
Noisy when receiver is jarred	1)	inspect to see if solder lug on automatic tuning unit has worked through the paper insulation under it so it touches the metal motor frame. Place a strong, thick piece of insulating paper or cloth under the lug (do not bend lug)

CROSLEY A-266

Intermittent reception, Noisy	1)	replace 0.006-mfd. bypass condenser connected from 25A6 plate to 30-mfd. electrolytic condenser. Use 1,000-volt replacement unit

CROSLEY 305 CHASSIS

Intermittent reception	1)	intermittently open-circuiting heater in the type '27 first audio tube. Replace with new tube
	2)	intermittently short-circuiting 0.5-mfd. detector cathode resistor by-pass condenser, resulting in no bias on the type '27 detector tube. Replace
	3)	decrease in value of 55,000-ohm first detector plate supply resistor. Replace
	4)	leaky 0.001-mfd. r-f by-pass condenser connected between plate and cathode of the first detector tube. Replace
	5)	leaky a-f coupling condenser between the first detector plate choke and the control grid of the first audio tube
	6)	leaky electrolytic condensers. Replace with new units
Noisy reception, Unstable operation	1)	change in value of the 11,000-ohm stabilizing resistors connected in parallel from the B-plus terminal of the audio transformer to ground. Replace

CROSLEY NP-358 Record Changer

Record drops on tone arm	1)	bend back end of follower arm up slightly. Make certain that ejector screw is adjusted properly
Records do not drop	1)	ejector arm screw must be set slightly higher. Check with full stack of 10-12" records. Set screw so bottom record will just fall
Tone-arm sets down on record improperly	1)	loosen tone-arm crank screw and turn tone-arm slightly in proper direction if arm is ⅛" or more off. If only slightly out of adjustment, bend tabs on either side of index slide
Turntable rubs	1)	loosen small set-screw on worm with Allen wrench and raise spindle about 1/16"
Motor slows down during cycling	1)	bend paddle end of follower arm down slightly, or set ejector screw back slightly
Follower arm binds	1)	bend follower arm away from fulcrum at both sides of rivet
Follower jams	1)	straighten follower arm by bending
Follower flutters while playing	1)	inspect to see if follower arm is all the way up to top of worm; if not, bend arm slightly in toward worm to stop binding
Noisy while cycling	1)	follower arm bent out of position. Straighten
Lift pin slides off follower arm	1)	bend arm to center it over left pin

CROSLEY 401

Variable condensers "freeze"	1)	the tuning condensers sometime "freeze" up so they turn hard. Drill a ⅛-inch hole through the die-cast bearing of each condenser section to the shaft. Drop a little oil and graphite in each hole. Now turn the condensers back and forth to work in the lubricant

CROSLEY 418

Whistling or squealing	1)	detector grid return now connected to chassis through an antenna coil winding. Ground grid return directly to chassis

CROSLEY 425B (Battery Receiver)

Inoperative when "C" battery is connected—O. K. when it is disconnected	1)	check 2,000-ohm flexible resistor on volume control for "open"
Intermittent reception	1)	internal "shorting" of the untuned r-f transformers (one terminal of which is connected to plate terminal of last r-f tube
"Range" or "Sensitivity Control" switch noisy	1)	solder flexible pigtail from wiper arm to ground
Distortion	1)	"leaky" dual 0.5-mfd. condenser which by-passes second detector and first a-f bias resistors
Speaker rattle	1)	remove cone from speaker. Paint the joints inside and out where the voice coil fastened to the cone (use good grade of glue or thin shellac). If voice coil wires are loose, shellac the entire coil

CROSLEY 515

Inoperative	1)	"open" in 2-section Candohm resistor at rear of chassis sub-base (overall resistance 33,500 ohms; long section 25,000 ohms; short section 8,500 ohms). If any one section opens a 5-watt resistor of corresponding resistance may be used as a replacement for that section
	2)	if set does not turn "on" install an "on-off" switch separate from the volume control
	3)	"short" in 0.006-mfd. condenser connected between plate *No. 2* and ground of 6B5 tube (unit is in same tubular container with 0.02-mfd. tone control condenser, *center* terminal being common to both sections)
Intermittent operation with strong hum	1)	dirty contact points and "shorts" in electrolytic condenser. Unsolder and test for "shorts" or opens
Weak or intermittently weak reception	1)	defective dual 0.02-mfd., 200-volt type '6D6 tube cathode by-pass tubular condenser (even though it may test O.K.). Replace with a new unit
	2)	check for "open" in speaker voice coil circuit
Fading	1)	faulty or "open" "Litz"-wire r-f coil

CROSLEY 516

Intermittent operation, Sputtering and chattering	1)	check speaker voice coil for continuity—especially broken leads to voice coil
	2)	voltage-divider resistance values changed. Correct values are: feeder 8,500 ohms, 2-watts; bleeder 25,000 ohms 1-watt

CROSLEY 517T

Inoperative on broadcast band	1)	check band switch for broken or loose internal contacts
Distortion	1)	16-mfd. filter can is insulated from chassis by two fibre washers. As the can is located in the rear of the chassis and is handy for lifting the chassis when handling the set it may slip just enough to throw it off center and short to the chassis. Re-center the can in the hole and tighten securely in place

CROSLEY 534

Weak reception	1)	replace 10,000-ohm resistor *No. 40* with a 13,000-ohm ½-watt unit. Replace 300,000-ohm 75 tube plate filter resistor with a 250,000-ohm ½-watt unit (connecting plate supply end to high-voltage end of Candohm voltage divider resistor *No. 41-42*)

CROSLEY 555

Weak reception	1)	"leaky" condenser *No. 14* connected between converter anode grid and primary of oscillator coil

CROSLEY 566 Battery Receiver

"Put-put" (motorboating) sound as volume control is advanced	1)	add a 25-mfd. 25-volt electrolytic condenser for better filtering (connect condenser *plus* terminal to "B" minus terminal within the chassis, and condenser *minus* to chassis)

CROSLEY 597

Distortion	1)	check 25Z6 and 25A6 tubes. Replace filter condenser *No. 44935* (use a type insulated from ground)

CROSLEY 597-B

Same Case History as that listed for Crosley A-266 receiver

CROSLEY 601 (BAND-BOX)

Inoperative (voltages check O.K.)	1)	"shorted" neutralizing condenser. Locate and repair the short. Neutralize the receiver
Filament rheostat burns out	1)	install new rheostat—being careful that its shaft does not "ground" against metal panel
Tuning control cord "frozen"	1)	free the cord and rinse out carefully. Otherwise, install new cord
Squealing, Howling	1)	variable condenser rotor sections slipping on the shaft. Trouble often is difficult to find, as the condensers are mounted upside down in the receiver. Tighten and align the tuning condenser rotor sections
Improving selectivity	1)	"short" out the first-stage balancing condenser. Make sure that the plates of the tuning condensers mesh properly
Variable condensers "freeze"	1)	see the Case History listed for this trouble under Crosley 401 receiver

CROSLEY 602

Variable condensers "freeze"	1)	see the Case History listed for this trouble under Crosley 401 receiver

CROSLEY 608 (GEMBOX)

Reception cuts off near 100 on dial	1)	check tuning condensers for burrs which "short" the plates when half meshed. Also check them for spacing and "tracking"
Regeneration control "freezes"	1)	replace the control
Tuning control "freezes"	1)	repair by smoothing the burrs on the gear and holes where it turns. Otherwise, replace the drive gear
Hum	1)	loose power transformer laminations. Loosen lockbolts and hit laminations gently with hammer to "set" them. Tighten bolts carefully
Volume control noisy	1)	clean with 0000 sandpaper gently and rub with vaseline—or replace

CROSLEY 609 (GEMCHEST)

Sensitivity poor	1)	shift the positions of the r-f coils until best sensitivity is obtained. Fasten them in these positions
Whistling, Weak reception, Poor selectivity	1)	readjust angles or positions of the three r-f coils in relation to one another (the detector coil—first one toward front of receiver—is the most critical)
Noisy tuning	1)	corroded condenser gang rotor shaft tension spring. Connect a flexible pigtail between the condenser rotor and chassis
Distorted reproduction	1)	open-circuited 10,000-ohm resistor in secondary return circuit of output tube

CROSLEY 610 (GEMBOX)

See also Case Histories listed for Crosley 609 (Gemchest)

Fading, Increased hum level	1)	loose rivets on the center-tap filament resistor. Remove resistor and squeeze the rivets securely in a small vise

CROSLEY 616

Weak reception (B voltages low)	1)	"shorted" 0.002-mfd. condenser at 6N6 tube socket

CROSLEY 617

Intermittent reception Noisy	1)	tighten 6A8G tube socket clamps, then realign receiver

CROSLEY 628

Fading, Erratic operation, Distortion	1)	replace volume control with improved type Crosley control

CROSLEY 629

Fading on both phono and radio	1)	check 0.006-mfd. condenser connected from center terminal of volume control to 6Q7G tube socket

CROSLEY 630 Auto Radio

Ringing, howling	1)	due to microphonic 6D6 tube. Try several tubes and select best one. If unable to obtain microphonic-free operation, reduce sensitivty of receiver by moving small piece of regeneration-control wire soldered to stator of middle section (and lying over near stator of first section) of condenser gang. Move it just far enough to clear up microphonic condition

CROSLEY 635

Inoperative, Whistling, squealing	1)	check condenser *No. 17B* in the schematic, connected between the cathode and screen of the 6A7 tube
Whistling or squealing, Inoperative	1)	"leaky" .02-mfd. by-pass condenser *No. 17B* from screen to cathode of 6A7 tube

CROSLEY 636

Intermittent whistling, squealing or howling	1)	replace class "B" input transformer part *No. 24628*

CROSLEY 637

Erratic whistling when tuned	1)	replace 0.02-mfd. screen by-pass condenser on first det. and the i-f tubes to a 0.1-mfd. 200-volt unit

CROSLEY 638

Fading, Erratic operation, Distortion	1)	replace volume control with improved type Crosley control

CROSLEY 639 Record Changer

Motor will not start	1)	faulty phono-radio switch
	2)	"open" motor winding or leads
	3)	motor stopped in an overload posiiton, i. e., record drop cam and cam roller are at point where roller is just about to lower shelf. Turn the turntable (clockwise) two or three revolutions by hand Note: The turntable screws down on the record spindle. To remove, turn in clockwise direction by hand until the curve on the spindle is toward the loading rack, then lock small drive pinion in that position. Spindle must not turn. Unscrew turntable (counter clockise)
	4)	friction drive pulley stuck, friction drive pulley not touching turntable rim or bushing on motor shaft not touching friction drive pulley. Oil on friction drive pulley
	5)	center pinion shaft stuck or tight. Free and oil When replacing be very careful so as not to bend or spring the friction drive pulley which will have to be pushed under the edge while screwing the turntable in position
Trips before record is finished	1)	clutch too tight. Loosen special setscrew in the collar nearest base of changer with a No. 6 Bristol wrench. Turn collar a fraction of an inch to left (counterclockwise). Tighten setscrew. Check and repeat until record plays to end
Does not trip after record is finished	1)	center groove on record does not have sufficient pitch to develop enough torque to actuate clutch. This may result from improperly cut trip groove in record or loose clutch setting
	2)	it may be possible that the trip arm may have jumped to the wrong side of the rocker bar trip arm. It should be on the same side as reject arm
Drops more than one record	1)	warped record
	2)	spindle alignment incorrect
Tone arm drags on record	1)	too many records on turntable
	2)	records warped
	3)	needle too long, or not properly seated
	4)	tone arm lift-adjusting screw loose or out of adjustment

CROSLEY 644

Inoperative (possibly weak signals on high-freq. end)	1)	"open" 0.1-mfd. condenser connected between waveband switch and anode grid of 6A7 tube

CROSLEY 645 (32-volt d-c receiver)

Intermittent distortion (accompanied by varying output)	1)	broken lug in the '48 tube socket
	2)	check all other tube socket lugs for defects

CROSLEY 648

Receiver does not start to play until switch has been turned on and off several times Intermittent reception	1)	replace 60,000-ohm resistor connected from oscillator grid to chassis with a good 70,000-ohm unit
Inoperative (only slight noise heard)	1)	leakage through mica insulation of oscillator padder condenser mounted on gang condenser. Take apart and clean all dirt or dust from stationary plate. Examine mica for pin holes. Reassemble padder, and align both trimmers at 1725 kc

CROSLEY 655

Distortion (especially at high-volume)	1)	weak 6F6 power tube
	2)	poor 5Z4 rectifier tube
	3)	check output voltage of filter. If below normal it is likely that one of the filter condensers has excessive leakage. This additional current drain would cause the output voltage to drop and the power transformer to heat excessively

CROSLEY 689

Alignment precaution	1)	in this receiver, the 2.3 to 2.5-mc police band is covered by resonating the tapped loop at 2.4 mc and using the *image* frequency (which is 910 kc) When "shunt aligning" the short-wave band, care should be exercised so that the circuits will be aligned on the fundamental rather than the image which is 910 kc more than the fundamental. To check on this, increase the signal generator output about ten times and try to tune in the signal both at the signal generator frequency as indicated on the tuning dial, and at approximately 910 kc less than the correct frequency (18-mc fundamental, 17.09-mc image). If circuits have been properly aligned, the signal can be tuned in at both positions but with a much stronger signal on the fundamental The 2.3 to 2.5-mc police band in some of these models has no adjustment, but can be checked by using a .0001-mfd. condenser in series with the signal generator output lead. With bandswitch in "Pol." position and signal generator set to 2.5 mc, the signal should come in with the receiver dial pointer near the end of that band

CROSLEY 704, 706 (SHOWBOX)

Inoperative (no plate voltage on r-f tubes)	1)	0.5-mfd. r-f by-pass condenser "shorted"
	2)	check 3,250-ohm r-f resistor
Inoperative (no plate voltage on first a-f tube)	1)	loose spring-contact at "plate" prong of first a-f tube socket. Repair, or replace with a new socket
Inoperative, High-voltage output shorted	1)	filter choke leads "shorting" to chassis
	2)	speaker field pin-jacks "shorting" to chassis

(Cont'd over)

CROSLEY 704, 706 (SHOWBOX)—(*Cont'd*)

Intermittent reception ('26 tubes light up intermittently)	1)	loose 1.5-v. filament winding riveted-lug on the terminal strip of the power unit. Check all other riveted lugs on this strip also, and tighten securely
Intermittent reception	1)	screw on aerial terminal works loose due to worn or faulty threads. Solder a small length of wire to lug under screw and attach aerial to other end of wire instead of to terminal
Fading	1)	solder one end of a piece of wire to the bottom of the aerial lug. Fasten the other end under the screw at the top of the aerial and ground strip
Noisy tuning	1)	corroded condenser gang rotor shaft tension spring. Connect a flexible pigtail between the condenser rotor and chassis
	2)	burrs on stator tuning plates. Can be cleaned off with a long sharp knife blade
Noisy reception	1)	clean the volume-control resistance element and contact arm
Whistling, General instability	1)	open-circuited type '226 tube filament by-pass condenser
	2)	readjust balancing condenser
Whistling when dial is touched or moved	1)	take out washer located between the condenser housing and the pinion gear. Sandpaper it and the points with which it makes contact. Bend it so that firm connection is made when it is put back
Hum (steady)	1)	faulty Mershon electrolytic filter cond.
Howling during "warm-up" period (stops if first audio tube is removed)	1)	shunt grid circuit of first audio tube with a 500,000-ohm resistor. Also, change the detector grid resistor to 1 megohm
Fuse blows	1)	replace fibre bushings on field supply
Voltage divider gets extremely hot	1)	replace 0.5 mfd. condenser from center arm
Dial light flickers, Noisy	1)	replace the a-c line switch
Poor tone	1)	if volume increases when one of the output tubes is removed, check the small wires on the *"F"* type speaker unit for a "break"
Raspy tone Harsh, Fuzzy	1)	check rubber damping blocks at the ends of the loudspeaker armature unit for hardened condition. Replace with new ones of thin "live" rubber. Re-assemble unit, adjust properly

CROSLEY 706-60

Excessive hum (circuits check O.K.)	1)	replace the '27 detector tube with a '56, and connect a 0.1-mfd. 200-volt condenser from chassis to detector heater at the fourth terminal from front of chassis on brass strip which connects power pack with chassis
Distortion	1)	replace the 1,100-ohm bias resistor. A standard 1,000-ohm 10-watt resistor will do for replacement

CROSLEY 714

Inoperative (no r-f plate voltage)	1)	"shorted" 0.5-mfd. by-pass condenser
	2)	foregoing condition generally causes the 3,250-ohm wire-wound plate resistor to become excessively hot—or burn out. Check both these possibilities and make necessary replacements

CROSLEY 715

Intermittent reception, Whistling	1)	if normal operation is resumed when finger is placed on the grid cap of the 2B7 tube at the rear of the chassis, replace the faulty 3-section filter condenser (part *W-36056*)

CROSLEY 716

Inoperative on broadcast band	1)	loose connection on the frequency series-adjustment
	2)	"open" or "intermittently open" wire-wound oscillator plate resistor. Replace with carbon unit
Noisy when tuned to resonance	1)	faulty 6A8 oscill.-mixer tube—even though it tests O.K. Try several tubes
	2)	"open" or "intermittently open" wire-wound oscillator plate resistor. Replace with carbon unit

CROSLEY 718

See also Case History listed for Crosley 714 receiver

Fading, Erratic operation, Distortion	1)	replace volume control with improved type Crosley control

CROSLEY 725

Inoperative (set smoking, no voltages on plates, condensers O.K., two 10,000-ohm resistors heated)	1)	tuning meter "shorted". Replace tuning meter and both 10,000-ohm resistors

CROSLEY 726

Inoperative (no screen-grid voltage on 6A8 tube and 6K7 i-f tube)	1)	check 16,500-ohm section (*No. 57-Z*) of Candohm resistor

CROSLEY 729

Alignment precaution	1)	in this receiver, the 2.3 to 2.5-mc police band is covered by resonating the tapped loop at 2.4 mc and using the *image frequency* (which is 910 kc)
		When aligning the short-wave band follow the precaution instructions listed here for the Crosley 689 receiver

CROSLEY 804 (JEWELBOX)

Distortion about 20 minutes after receiver is switched on	1)	"leaky" 0.25-mfd., 400-volt by-pass condenser connected from the B-plus cathode of the first type '27 a-f tube

CROSLEY 814

Distortion, Low volume, Inoperative	1)	open-circuited section in 10,000-ohm "Candohm" resistor section connected between the screen circuits and ground

CROSLEY 816

Rattling sound from speaker	1)	loose sections in plywood sound diffuser baffle. Remove speaker from baffle board and firmly glue back any loose layers of plywood

CROSLEY 855

Inoperative	1)	check all electrolytic condensers

CROSLEY 885

Whistling, squealing on high-freq. end of 15 mc band — 1) connect a resistor of about 50,000 ohms from grid end of oscillator coil to ground

CROSLEY 955

Inoperative, Noisy, Intermittent operation — 1) check 1,100-ohm flexible type bias resistor *No. 46* connected from cathode of 6C5 driver tube to ground

CROSLEY 1117

"Fuzzy" tone — 1) install special shielded lead (*No. G123-34403*) between center arm of volume control and the coupling condenser

Loud hum — 1) tighten the mounting nut on the grounded filter condenser so as to make better electrical contact

Noisy tone control — 1) ground control shaft with a pigtail lead

Noisy tuning — 1) caused by belt drive shaft. Ground the shaft by installing a flat wiper spring bolted to chassis and pressing against end of this shaft

Poor tuning-eye action — 1) remove the cathode lead (black wire) from ground and connect it to the lower end of the diode load resistor

CROSLEY 1127

Poor tuning-eye action — 1) remove the cathode lead (black wire) from ground and connect it to the lower end of the diode load resistor

CROSLEY 1137, 1217, 1218, 1227

Motor not stopping at station, Drifting past station — 1) mix a 50% solution of kerosene and light mineral oil. Remove the chassis. With a small camel hair brush, dab the solution in the clutch and clutch finger assembly, at the same time working the tuning knob back and forth so as to thoroughly work in the solution. If a very dirty clutch is encountered, the above operation may have to be repeated within a few days. In most cases, however, one cleaning will be sufficient to assure good operation

Dial stops or sticks at in-between station points — 1) replace driver belt and rubber sleeve on tuning shaft with new *Type 45449* sleeve and *Type 45448* belt

CROSLEY 1516

Neon tuning indicator fails to operate — 1) "open" 30,000-ohm resistor *No. 68*

CROSLEY 5515

Same Case History as that listed for Crosley 515 receiver

CROSLEY 5666

Intermittent reception, Noisy — 1) replace the volume control

CROSLEY 5597

Distortion — 1) replace filter condenser No. 44935 (use a type insulated from ground)
2) check the 25Z6 and 25A6 tubes

CROSLEY 5628

Fading, Erratic operation, Distortion — 1) replace volume control with improved type Crosley control

CROSLEY 6625

Weak reception (in receiver using 6B5 power tube) — 1) "leaky" 0.05-mfd. coupling condenser from 76 tube to grid of 6B5 tube

---

DAYFAN

DAYFAN 5005-A

Oscillation between 1400- and 1500-kc — 1) connect a 0.01-mfd. condenser between the screen-grid on the first r-f tube and the ground post, insulating the ground post from the chassis. Make sure that the ground wire goes directly to the condenser and not to the post

DAYFAN 5066

Inoperative, Weak reception — 1) check for faulty speaker condenser

---

DAYTON

DAYTON A.C. "NAVIGATOR"

Inoperative — 1) defective a-c switch. Replace

DE CHAMPE Receivers

Loss of volume — 1) magnetic speaker armature off center.

DE FOREST-CROSLEY

See also Case History listings for CROSLEY receivers

De FOREST-CROSLEY 707

Intermittent reception — 1) open-circuiting detector plate choke. Replace with a 17-mhy. unit

De FOREST-CROSLEY "ARIA" 740, "TROUBADOR" 750

Loud hum — 1) faulty 3-section "Mershon" filter condenser. Replace with a new unit or drill a hole in the hard rubber top and fill the can to within about ½-inch of the top with distilled water. Then seal up

De FOREST-CROSLEY (CANADIAN) "ARIA", "MELODY", "TROUBADOR"

Distortion at low volume — 1) decrease in resistance of 20,000-ohm, 2-watt carbon bleeder resistor connected between the r-f plate supply and the cathode of the audio tube. This causes over-biasing of the a-f tube. Discard the bleeder resistor and self-bias the tube with a 2,000-ohm, 1-watt unit

Low volume, Poor tone — 1) faulty speaker voice coil
2) open-circuited field coil in speaker

Squealing (when set is first turned on) — 1) gassy '45 power tube. Test the tube, and replace if necessary

De FOREST-CROSLEY 762

Weak reception, Distortion, Gradual rise and fall of volume — 1) if plate voltages and currents are low on all but the power tubes, check the 0.5-mfd. r-f plate by-pass condenser for leakage. Use a 500-volt unit for replacement

De FOREST-CROSLEY "MINSTREL" 810

Loud hum	1)	faulty 3-section "Mershon" filter condenser. Replace with a new unit or drill a hole in the hard rubber top and fill the can to within about ½-inch of the top with distilled water. Seal the hole with sealing wax

DELCO (United Motors Service)

DELCO 500, 630 Auto Radios

Insensitive, No distant reception Blocking of nearby stations	1)	blocking of weak signals by noise-suppression circuit. Disconnect the volume control "grounding" wire from the chassis grounding lug. Connect this end of the wire to the cathode terminal of the '6D6 tube instead. If this causes resulting audible vibrator noise, connect a 100-ohm resistor in series with the 275-ohm common bias resistor for the '6D6 and '6B7 tubes. Put it between the cathode and the old resistor, re-connecting the by-pass condenser across both the old and new resistors. Connect the lead from the volume control to the junction between the resistors

DELCO R-641

Intermittent reception, Fading	1)	resolder all oscillator coil connections

DELCO R-644

Intermittent reception, Fading	1)	check for "short" to lug on loading coil in series with antenna coil
	2)	resolder all oscillator coil connections

DELCO R-1117

Poor tone	1)	readjust speaker by drilling out riveted washer which holds spider in place. Adjust cone so it is properly centered, fasten back with same washer and a self-tapping screw
Weak reception, Tuning eye inoperative	1)	ground the *brown* lead which is connected to the tuning eye socket

DELCO R-1118

5V4G rectifier tube burns out repeatedly	1)	replace the two 0.006-mfd. paper condensers connected between the 6L6 output tube plates and chassis. Use 0.005-mfd. 1600-volt condensers

DELCO R-1119 Auto Radio

Line fuse blows while set is warming up	1)	replace 8-mfd. 250-volt electrolytic condenser with a 400-volt unit
Receiver inoperative, Tuning eye inoperative (no plate voltage on 6L7 tube)	1)	"shorted" 0.01-mfd. by-pass condenser across 15,000-ohm resistor
	2)	check the 15,000-ohm resistor for damage due to overheating. Replace

DELCO R-1126

Whistling or squealing	1)	replace the 8-8 mfd. dual filter condenser. If a high-pitched whistle still persists, connect a 0.002-mfd. by-pass unit from output tube plate to ground
Noisy reception	1)	faulty first i-f transformer. Resolder all connections. If this does not help, replace coil

DELCO R-1129

Distortion and hum when signals are tuned in	1)	6E5 tube not operating. Replace it

DELCO 3201, 3202 (32-Volt Receivers)

"Put-put" (motorboating) sound between stations	1)	line voltage too high. Install automatic voltage control tube to keep receiver input voltage at 32 volts. (Receiver draws 1.5 amp. at 32 volts)

DELCO R-6015

Noisy reception when volume is turned up	1)	replace vibrator
	2)	after replacing vibrator, but before placing receiver back in operation, check filter condensers for excessive leakage

DELCO 1936, 1937 Auto Radios

Hum (loud & intermittent)	1)	rivets which hold the electrolytic condenser bracket to the chassis "loose". Bond the bracket directly to the chassis with copper bonding braid soldered in place
Difficult to align correctly without squealing or uncontrollable oscillation	1)	particularly common on models using 6A7 and 6B7 tubes. Grid and plate prong on 6A7 are very close together, causing feedback. To remedy, cut lead to plate prong to absolute minimum, and shield it. Also insert an insulated piece of braid between the grid and plate prongs to act as a shield. Ground braid

DETROLA

DETROLA "MIDGETS"

Distortion	1)	replace the 0.5-meg. plate resistor of 6C6 detector with a 0.25-meg. unit

DETROLA "WARWICK" MODEL

Inoperative over part of broadcast band	1)	replace the 50,000-ohm voltage-dropping resistor for the screen grid of the '57 detector-oscillator tube, with one of lower value (about 40,000 ohms)
Weak reception	1)	the 50,000-ohm screen-supply resistor usually increases in value, thereby reducing the voltage available for screen supply. Replace with a 2-watt resistor

DETROLA 1C, 1T, 2C, 3C

Hum between stations when tuning electrically	1)	try several new 75 tubes
Tuning stops at off-station points when tuned electrically	1)	inspect ribbons fastened to drums and carefully clean off any burned spots with fine emery cloth and carbon tetrachloride

DETROLA 5B

Distorted, chopy operation after about 10 minutes of playing	1)	"open" section of Candohm resistor located at the right of the "ground" connections on the Candohm. Replace with 100-ohm 5-watt unit

DETROLA 5C

Same Case History as that listed for Detrola 1C receiver

DETROLA 6P2, 6W

Weak reception, Distortion	1)	voltage checkup shows '42 tube to be underbiased and '75 tube to be overbiased. Caused by leaky 0.01-mfd. 400-volt coupling condenser
	2)	check for "shorted" 25-mfd. condenser across 42 tube bias resistor
	3)	check 75,000-ohm plate resistor in i-f stage

DETROLA 191E

Hum	1)	reverse the speaker field winding
Power transformer overheats	1)	check for "short" where leads pass thru hole in chassis

DETROLA 288

Whistling, Noisy, Shifts off tuning	1)	the negative A and B terminals are grounded to socket, and the rivets fastening socket frame to chassis make poor electrical connection. Solder socket frame firmly to chassis

DETROLA 310

Hum	1)	if receiver employs a Candohm resistor enclosed in a perforated can, check to see if it has slid down and is "shorting" on one end to its metal casing. The casing is connected to the chassis, which is *not* grounded

DETROLA 1116

Inoperative	1)	"shorted" condenser in plate circuit of output tube
Whistling or squealing all over dial	1)	add 1,500-ohm 1-watt carbon resistor from the screen-grid terminal of the 6K7 tube to chassis
Distortion	1)	replace "leaky" coupling condensers
Hum	1)	replace faulty 8-mfd. electrolytic condenser unit

DETROLA 3101

Same Case History as that listed for Detrola 310 receiver

DE WALD

De WALD "BAG"

Inoperative	1)	open-circuited ballast lamp. Replace with new lamp

De WALD "DYNETTE"

Inoperative	1)	faulty line resistor. Replace with new unit

De WALD 61

Distortion, Hum	1)	cathode of '41 tube shorted to positive filament of '37 tube socket

De WALD 406R (Early Production)

Improving operation of early-production receivers	1)	change 100-mmfd. condenser between plate and cathode of 12F5GT detector to a 250-mmfd. unit. Change 25,000-ohm volume control to new type 25,000-ohm control having a 300-ohm stop incorporated at the cathode end

De WALD 506R

Hum, Distortion	1)	replace the filter block to clear up hum
	2)	connect a 1,000-ohm resistor between the cathode of the 6C6 tube and the chassis to clear up the distortion

De WALD 521

Low-pitched audio whistle	1)	add a 0.1-mfd. by-pass condenser from r-f coil B plus terminal to chassis

De WALD 527 Auto Radio

Production changes	1)	later production of this receiver incorporated several improvement changes in the antenna circuit. Instead of feeding the antenna lead (through a 0.01-mfd. series condenser) to the tap on the antenna coil, it is fed (through the same 0.01-mfd. series condenser) to the *bottom end* of the antenna coil. Instead of connecting the bottom of the antenna coil to the ground (through the 0.05-mfd. AVC return by-pass condenser), this condenser is changed to one of 0.002-mfd. and it is connected between the ground and the tap on the antenna coil. The 150,000-ohm resistor in the AVC return goes to the junction of this new condenser and the tap on the coil

De WALD 547-A

Inoperative, Whistling, Hum	1)	check all filament socket prongs for intermittent "grounding" of half the filament voltage. This will overload the transformer and cause hum. To remedy, simply bend the prongs so this cannot occur
	2)	oscillation may usually be cleared up by cleaning the rotor contacts of the condenser wipers and securely soldering them to the chassis

De WALD 617 Auto Radio

Ignition interference	1)	although this receiver has been designed to operate without ignition system suppressors, if it is installed in an older model car (or the ignition system is faulty) it may be necessary to install a suppressor in the main H.T. lead. In bad cases, spark-plug suppressors may also be needed. The breaker point and spark-plug gaps should be correct (see Section 5 of this book for correct breaker-point and spark-plug gap values for all makes and models of cars)

DeWALD 632 D.C.

Inoperative, Tubes do not light	1)	burnt-out pilot light

DeWALD 802

Hum	1)	install by-pass condensers for the '2A5 and '2A6 tubes
Distortion on short-wave band	1)	faulty 0.05-mfd. type '2A7 grid return circuit by-pass condenser. Replace with new unit

---

DICTOGRAPH

DICTOGRAPH 91-134 AC-DC

No signal in Mystic Ear	1)	check motor coil for a "short" or "open" in moulded case of Mystic Ear for the trouble

---

DODGE (PHILCO) Auto Radios

(For routine auto-radio Installation and Ignition Interference Suppression Data pertaining to all models of Dodge cars, see *Section 10* of this *Handbook*. For methods of Eliminating Persistent Ignition System Interference in various models of Dodge cars, see *Section 11* of this Handbook)

DODGE (PHILCO) Auto Radio

Insufficient sensitivity when used with rod-type antennas	1)	remove shield can on side of receiver to which antenna is connected, and "short" the small choke found in series with the antenna lead. Realign first r-f stage
Ignition noise	1)	ground antenna lead-in shielding under head of a self-tapping screw inserted in small hole already existing in the cowling under the hood on the driver's side of Dodge cars

DODGE (PHILCO) C-1608 Auto Radio

Push-button tuning becomes faulty so that stations on low-freqeuncy end of dial will not come in	1)	faulty 0.00028-mfd. series padder condenser. Replace this and the 0.0005-mfd. padder with bakelite encased units for more reliable operation

DODGE (PHILCO) 1939 Auto Radios

Dial pointer does not operate	1)	dial cord jumps off pulley

DODGE (PHILCO) 1940 Auto Radios

Manual tuning inoperative (pushbutton tuning O.K.)	1)	flexible shaft broken at tuning knob end fitting. Cut replacement shaft about ¼" longer than original to allow more play when it is rotated

EARL

EARL 21, 22

Inoperative	1)	faulty 4,700-ohm resistor (the large *yellow* carbon resistor). Use a 5,000-5-watt unit for replacement
Inoperative Reversed plate readings on r-f and first-audio tubes	1)	2-mfd. filter condenser "shorted"
Inoperative (no detector plate voltage)	1)	"open" detector plate-supply resistor. Replace
Will not neutralize	1) 2) 3) 4) 5)	"open" by-pass cond. in the r-f plate circuits "shorted" r-f plate choke faulty neutralizing condenser "open" neutralizing circuit try other tubes
Hum	1)	check pilot light current for "grounding." Reverse either the *yellow* and *orange*, or the *red* and *green* leads in the filter condenser circuit
Tubes blow, (r-f secondary coil burnt out)	1)	antenna variometer shaft "shorting" to chassis
Whistling or squealing	1)	"leaky" or "open" 0.001-mfd. detector plate by-pass condenser
Noisy reception	1)	the two screws which fasten the variometer and the insulating bakelite strip to the chassis are loose. Tighten them

EARL 31

Same Case Histories as listed for Earl 21 and Earl 32 receivers

EARL 32

Inoperative (no plate voltage on '27 tube)	1)	"open" large enamel wire-wound resistor—either the 5,000-ohm or the 4,000-ohm section. The faulty section can be shunted with a 5-watt resistor of the proper resistance value
Replacing dial assembly	1)	when it is necessary to replace the dial assembly for any reason, use a Philco 90 dial assembly, as it is easily obtained. File off the five rivets which hold the dial scale of each unit, and remove the scales. Now fit the Earl scale to the Philco assembly

ECHOPHONE

ECHOPHONE—All Models

Intermittent reception	1)	poor mechanical contact between the wipers and the shaft of the variable condenser gang. Clean all these contacts and make them secure

ECHOPHONE MODEL C

Inoperative, Whistling or squealing	1)	loose or bent socket contacts, causing poor contact at tube prongs
Poor sensitivity, Hum	1)	substitute a type '56 tube in place of the type '27 tube
Improving performance of the receiver	1)	replace the '01A tubes with type '26 tubes as follows: Remove one of the 5-volt *brown* filament supply leads and connect it to the centertap at the *blue* lead (which should be removed). Connect this *blue* lead to the centertap of a 40-ohm resistor which has been connected across the new 2.5-volt filament supply. The current drain of the '26 tubes will cut the voltage of the 2.5-volt winding so it will be correct for them. Also connect a 0.025-mfd. condenser from the plate of the '71A tube to ground

ECHOPHONE S-3, S-4

Inoperative (burned-out antenna coil)	1)	rewind the primary coil with 250-turns of No. 36 wire. One turn at the antenna end acts as a dead end (for capacity-coupling), i.e., the antenna connection is to be taken from the *second* turn, leaving the outer end of the first turn free
Low volume, Loss of sensitivity with volume control at maximum setting	1) 2) 3)	open-circuited 1-megohm resistor connected from B-plus to the screen-grid of the type '24 detector tube. If faulty, an increase in volume will be noticed when the unit is shunted with the fingers. Replace this resistor with a new unit replace the r-f coils with litz-wound coils (used on the later type models). Realigning is necessary if this is done replace the porcelain-type 1-megohm control-grid bias resistor located on the resistor panel (which is fastened on the side of the chassis) with a new pigtail-type carbon unit
Noisy reception, Low volume	1) 2)	defective tone control condenser. Replace with new unit tuning condenser plates touching at certain positions. Bend these out so that they will not touch

(Cont'd)

ECHOPHONE S-3, S-4—*(Cont'd)*

Whistling Low volume	1)	if the condenser wiping contacts are all clean and all by-pass condensers check O.K., replace the 0.5-meg. resistor from detector screen-grid to ground. This is the smallest one mounted on the resistor panel. When "open" it increases the detector screen-gid potential by about 20 volts causing oscillation and low volume
Improving reception	1)	replace the screen-grid voltage resistor with a 200,000-ohm unit
	2)	replace the 0.1-mfd. screen by-pass condenser, as it often causes trouble due to "opening"

ECHOPHONE S-5

Inoperative	1)	remove the cardboard cover from the coils at the end of the chassis. Move the coils close, keeping them at the 90-degree angle
Acute loss of volume	1)	replace the porcelain-type 1-megohm control-grid bias resistor located on the resistor panel (which is fastened on the side of the chassis) with a new pigtail-type carbon unit

ECHOPHONE 60

Volume control operates erratically	1)	check the condition of the filter condensers (located directly under the power transformer)

EDISON

EDISON C-1, C-2

Same Case Histories as those listed for Edison R-1, R-2

EDISON C-4

Same Case Histories as those listed for Edison R-4, R-5

EDISON R-1, R-2

Inoperative, (all resistors and other components check O.K.)	1)	open-circuited 3-mfd., 1,000-volt filter condenser section, connected from one side of the high-voltage secondary to center-tap of '81 tube filament winding
	2)	"open" plate resistor in '26 circuit
	3)	"open" bias resistor in '250 tube circuit
Weak reception, No regeneration around 550-kc with regeneration switch in "On" position, Intermittent reception, (tubes and voltages test O.K.)	1)	poor ground connections from 1.5-mfd. plate by-pass condensers located in center part of chassis near volume control coupling shaft. Solder pigtails from their common ground to chassis
	2)	solder pigtail from rotor of tuning condenser gang to ground on chassis
	3)	tighten antenna binding post
	4)	tighten bolts in gang condenser, being careful not to throw it out of alignment
	5)	tighten the two screws in single-turn voice coil under the speaker
	6)	weak or faulty type '26 tubes
	7)	antenna too short
	8)	readjust compensating condensers
	9)	open-circuited grid-suppressors
Intermittent reception	1)	open-circuit in any one of the three 600-ohm grid suppressors
	2)	short-circuited trimmer condenser on the condenser gang Test for the above by tuning in a station and with volume control at maximum setting, move the trimmers slightly with an insulated tool and listen for any change in volume. Repeat the same with the suppressors
	3)	poor internal connection in one of the r-f condenser cases. Pull on leads or push on case to show up the fault

(Cont'd)

EDISON R-1, R-2—*(Cont'd)*

Poor sensitivity, Low volume, Hum	1)	replace type '27 detector tube and type '25 first audio tube with type '56 tubes, using the original 2.5-volt detector filament winding for heating the filaments of both tubes
	2)	remove the grid leak and condenser in the detector grid circuit, and bias that circuit with a 40,000-ohm, 1-watt resistor. By-pass with a 0.1-mfd. cond.
	3)	re-bias the first audio tube with a 2,700-ohm resistor in the cathode circuit, by-passing it with a 0.5- to 2.0-mfd. cond.
	4)	adjust hum controls
Noisy reception	1)	arcing between coil and core of plate transformer
	2)	arcing in '26 tube plate resistor
Troublesome units	1)	12,500-ohm series plate resistor; 1,500-ohm c.t. 50 bias resistor; and 25,000-ohm "losser" resistor. The ends of the first two have asbestos washers which absorb moisture and transmit dampness to the resistors, shortening their life. Replace third resistor with a 10-watt unit whether it checks O.K. or not

EDISON R-4, R-5

Low volume	1)	"open" r-f by-pass condensers. Best to replace all three r-f by-pass units with 0.1 to 0.5-mfd. to prevent future trouble with them
Weak, choked reproduction (high cathode voltage on '27 first a-f stage)	1)	"leaky" 0.16-mfd. 300-volt "hum-balance" condenser connected from plate supply to one end of the 6,000-ohm resistor (the other end of this resistor connects to the cathode of the '27 first a-f tube). This condenser may be disconnected and left out entirely in most cases without any effect on the receiver
Poor tone, Condensers blow, Plate voltages high	1)	open-circuited 10,000-ohm "loss" resistor in power pack. This resistor should be checked frequently, as it is the cause of most trouble in these sets
Hum, Distortion	1)	filament winding of type '45 tube short-circuiting to the filament winding of the type '27 detector tube, depriving the '45s of their biasing voltage, since the center tap of the '27 tube is normally grounded. Repair by shifting the center tap on the type '27 tube from the ground to the type '45 filament winding center tap
Distortion (at low volume on weak stations)	1)	check to see if the thin edge of the speaker cone rubs against the pole or field housing. Remove the speaker head assembly . Carefully sandpaper all fuzzy material away and wipe all dirt and particles out from the voice coil space
Distortion (at low volume on powerful stations)	1)	faulty 10,000-ohm section of volume control. Try substituting a new one
	2)	check resistance between second r-f cathode and ground. If more than 5,000-ohms, shunt additional resistance (about 20,000-ohms) across this circuit to reduce it to this value
Detector hum adjuster burns out	1)	"short" between primary of power transformer and 2.5-volt filament winding. Hum adjuster may be disconnected from the receiver entirely, replacing the detector with a tube of later design
Whistling, Noise	1)	dirty contact wipers on variable condensers. Solder pigtail leads to the rotor and wiper arm and ground

(Cont'd over)

EDISON R-4, R-5—*(Cont'd)*

Whistling at high-frequency end of dial	1) 2)	first check to see if the receiver is properly neutralized check by-pass condensers (located on top of chassis), especially the 0.1-mfd. unit which connects from the cathodes to the plates of the second and third r-f tubes
Whistling at low-frequency end of dial	1)	0.001-mfd. condenser from detector plate to ground "open". It is located under the detector hum adjuster and choke subpanel
First r-f stage will not neutralize properly	1)	check 0.1-mfd. condenser from cathode to plate circuit of first r-f tube. If this is O.K., check the other condensers in this container
Poor tone '27 tubes deteriorate rapidly	1)	"open" 10,000-ohm loss resistor (8,000-ohms in the 25-cycle model) which is located in the power pack. Plate voltage rises to around 150 volts (instead of normal 115 v.) and by-pass condensers of top chassis often break down
Shrill sound (starts if room lights are snapped on or off)	1) 2) 3)	check power tubes for matching check plate voltage on power tubes. Possibly it is low check plate current of both tubes. It should be not less than 25 mils
Crackling (volume control setting has little or no effect on it)	1)	fine wires of detector choke partially "grounded" to case. Replace with a 50- to 65-millihenry choke

EDISON R-6, R-7

Inoperative or weak (plate voltages low or zero; bleeder resistor charred)	1)	"leaky" or "shorted" r-f by-pass condensers (located in one of the oblong cans at the rear of the chassis. Use 0.25-mfd. good quality tubular condensers for replacement
Inoperative, (very low or no screen voltage in r-f stages)	1)	short-circuited 0.5-mfd. condenser located in r-f filter unit connected between second and third r-f tube screens to ground
Inoperative (R-7 receiver)	1)	"open" primary winding in push-pull input transformer
Weak reception, (low plate voltages on all r-f tubes)	1)	short-circuiting of 0.05-mfd. condenser located in the detector filter unit, which is connected from the third r-f tube plate to ground
Intermittent reception, (stations tune in faintly then burst through strong and clear), (no det. tube plate volts)	1)	intermittent grounding of detector plate circuit r-f choke to case, causing a short-circuit to ground and the cut-off of the plate supply on the first detector tube
Intermittent reception	1) 2) 3) 4)	loose type '27 tube socket contacts. Tighten contacts, or replace socket defective phono switch. Replace defective power switch. Replace tighten all hexagonal nuts on power pack connector panel
Rumbling or drumming sound on low audio frequencies	1)	voice coil striking field coil housing at the bottom of the voice coil passage. Insert thick cardboard washer to give voice coil more travel distance

(Cont'd)

EDISON R-6, R-7—*(Cont'd)*

Whistling	1)	if all by-pass condensers, condenser rotor wipers etc. have been checked and found O.K., connect a 0.01-mfd. 600-volt condenser from the power-transformer side of the line switch to ground

EDISON-BELL

EDISON-BELL 35

Hum	1) 2)	replace power transformer with one having an electrostatic shield or connect two 0.25-mfd., 600-volt condensers in series across the a-c input, grounding their common connection to the chassis open-circuited grounding lead to electrostatic shield

EMERSON

EMERSON Motor-Generator or Dynamotor B-Eliminators

Low volume in receiver	1)	this trouble in receivers employing Emerson motor-generator or dynamotor B-eliminators for power supply generally due to failure to oil bearings of the generator. This causes reduced speed and hence lowered voltage output. Put a few drops of light oil in each bearing

EMERSON 4-TUBE A.C.-D.C.

Distortion, Low volume	1)	defective condenser connected between the plate and cathode of the type '38 a-f tube. This is usually a short-circuited unit. Replace with a 0.004-mfd.

EMERSON CU

Insufficient sensitivity for rural locations	1)	install a by-pass condenser across the 1,000-ohm 6J5GT cathode-bias resistor

EMERSON JS

Inoperative, Weak reception	1)	"shorted" 0.06-mfd. condenser connected between 7 plate and arm of tone control. Also check tone control for possible damage

EMERSON "Mickey Mouse"

See Case Histories listed under Emerson 409, 410, 411 receivers

EMERSON T

Whistling (especially when receiver is jarred or when tuning receiver)	1) 2)	bond tuning condenser frame to chassis for better electrical contact check for faulty filter and cathode by-pass condensers

EMERSON T, TS

Noisy tuning	1)	bend up the contact springs on the rotor of the tuning condenser, or attach a pig-tail lead from the rotor to the *chassis*
Intermittent reception, Distortion	1)	if plate currents of '24 detector and '47 audio tubes are far off from correct values, check the 0.01-mfd. grid-to-plate coupling condenser for leakage
Whistling on both long and short-wave bands	1)	bend the red wire (located between the speaker and the tuning condensers) toward the speaker

(Cont'd)

EMERSON T, TS—*(Cont'd)*

Insufficient sensitivity	1)	bend this same red wire toward the tuning condensers
Insufficient sensitivity on short waves	1)	increase feedback by connecting a lead to the control-grid of the '24 tube and bending it in place near, or around, the coil mounted on back of the '24 tube shield. Adjust its position until oscillation occurs uniformly over the dial

EMERSON 5A Auto Radio

Weak reception, Insensitive between local stations, Local stations tune in and out suddenly	1)	replace the 14,000-ohm cathode bias resistor for the '85 tube if it has greatly changed in value
	2)	replace 10-mfd. low-voltage condenser in same circuit

EMERSON L-AC-5

Whistling (tubes and voltages test O.K.)	1)	replace condenser *C-7* with a 0.0005-mfd. or higher unit

EMERSON U6—(Chassis U6D)

Inoperative	1)	heat generated in filament voltage-dropping resistor frequently causes loose connections at terminals of unit. Wind the leads securely on terminals—resolder
	2)	"open" 0.01-mfd. tubular condenser connected between grid of 75 tube and "low" end of i-f winding feeding diode plates of same tube
Weak reception	1)	faulty filter condenser. Replace entire block
Receiver drifts off frequency, (trouble appears only when set is in cabinet)	1)	overheating of midget-type compensating condenser in series with broadcast oscillator coil. Drill ⅝" hole in cabinet near condenser to ventilate it

EMERSON M-AC-7

Inoperative	1)	1) check for "open" 2000-ohm ½-watt cathode resistor on 58 tube
Whistling, Weak reception	1)	drop in value of 12,500-ohm, 2-watt resistor. Replace with a 10-watt wire-wound unit
	2)	leaky screen-grid by-pass condenser
Hum	1)	if filter is O.K. and other common causes of hum are not present, check for a partial short-circuit in high-voltage winding of power transformer. This throws the center-tap off

EMERSON 20A, 25A—(Chassis G4)

Loud crackling noise after being in operation about an hour	1)	intermittent short-circuit to chassis caused by a large lump of solder on one of the filter-choke lugs. The heat developed in the set after it is in operation for some time causes the fibre terminal strip on which the lug is mounted to bend toward the chassis, causing the intermittent short-circuit
	2)	defective 4-mfd. filter condensers. Replace with new units
Whistling	1)	remove the antenna wire coil from inside the case. Trouble will be caused by even a small amount within the chassis

EMERSON 26

Partial or intermittent distortion, Whistling, Overloading on strong signals	1)	faulty 15,000-ohm, ¼-watt screen voltage-dropping resistor for '57 second detector tube. Replace with a 1-watt unit
	2)	second-detector plate resistor has greatly increased in value. Replace
Weak, distortion	1)	replace 250,000-ohm resistor between the plate of the '57 tube and the screen of the '47 tube. (Try replacing this resistor even if it tests O.K.)

EMERSON 30—(Chassis H5)

Hum	1)	check tubes and condensers
	2)	if tubes and condensers check O.K. examine the line-ballast. If it is the type in which the resistance element is clamped in a metal holder with asbestos as an insulator between the two, put the set in operation and check for leakage from any tap on the ballast to chassis. The asbestos often absorbs moisture, causing leakage. If leakage exists, insulate the ballast from the chassis—or replace it

EMERSON 30AW, 31AW

"Put-put" (motorboating) sound—intermittently	1)	replace the 0.01-mfd. coupling condenser on grid of 43 tube
	2)	change the ¼-meg. grid resistor to one of 100,000 ohms

EMERSON 32—(Chassis U5S)

Inoperative, Hum	1)	"open" in the condenser block beneath the chassis. Shunt an 8-mfd. condenser across the terminals

EMERSON 33AW

"Put-put" (motorboating) sound—intermittently	1)	replace the 0.01-mfd. coupling condenser on grid of 43 tube
	2)	change the ¼-meg. grid resistor to one of 100,000 ohms

EMERSON 34C—(Chassis 6C, D6)

Inoperative	1)	"shorted" 0.1-mfd. by-pass condenser *C-25*, causing burnout of 6,600-ohm *R-4* portion of metal-clad wire-wound tapped resistor. Replace condenser with 600-volt unit and connect a 7,000-ohm 10-watt resistor across burned-out portion of tapped resistor
	2)	check 1-mfd. 200-volt condenser *C-9* for "short." Replace with 400-volt unit
	3)	check 10,400-ohm *R-2* portion of wire-wound tapped voltage divider resistor for burnout. Replace with 10,000-ohm 10-watt resistor connected across burned portion of voltage divider
Distortion	1)	"leaky" 0.000025-mfd. by-pass condenser in diode circuit
	2)	faulty audio coupling condenser
	3)	faulty bias cell (should measure 30 to 40 thousand ohms)
	4)	"open" 250,000-ohm volume control

EMERSON 36—(Chassis B5)

No screen voltage	1)	0.02-mfd. screen by-pass condenser "shorted" or "leaky." Replace with a 600-v. condenser. Since a "short" in this condenser usually causes the 9,000-ohm section of the voltage divider to burn, it is advisable to check this resistor also. If necessary, replace the divider with two separate resistors — one a 9,000-ohm 2-watt unit, and the other a 27,000-ohm 1-watt resistor

EMERSON 38—(Chassis U6, U6D)

Inoperative	1)	check for "open" 0.01-mfd. tubular condenser connected between 75 tube grid and low end of i-f winding which feeds diode plates of this tube
	2)	check for loose connections at terminals of voltage-dropping resistor—(loosened by heat from resistor)
Weak reception	1)	speaker field "open"
Distortion	1)	increase in value of 15,000-ohm cathode resistor of 75 tube. Replace
	2)	increase in value of 500,000-ohm plate resistor
Modulation hum on short-wave band only	1)	check 4-mfd. section of filter condenser for loss of capacity
Hum, Whistling	1)	"open" filter condenser

EMERSON 39—(Chassis DS-5)

Weak reception	1)	check plate voltage of 2B7 tube; if low, replace 100,000-ohm plate resistor
Intermittent reception, Noisy, Fading accompanied by rasping noises	1)	poor contact within the dual volume control. The section used in the a-f circuit of the reflexed '6B7 tube usually causes the trouble
	2)	if reception suddenly cuts off entirely, check the 0.05- and 0.02-mfd. audio coupling condensers for "opens"
Distorted reproduction (with abnormally high control-grid bias on '47 tube)	1)	open-circuited 250,000-ohm carbon resistor (one of the two resistors connected in series across the field coil)
Distortion (with low grid-bias voltage on '47 tube and grids of '47 tube glowing red)	1)	leaky 0.5-mfd. grid filter condenser in the grid circuit of the output stage

EMERSON 42 (Chassis U6, U6D)

Same Case Histories as listed for Emerson 38 receiver

EMERSON U-48

Audio oscillation	1)	connect a 100-mmfd. r-f by-pass condenser from 6C6 plate to cathode if one is not already in the receiver

EMERSON 49 (Chassis U6, U6D)

Same Case Histories as listed for Emerson 38 receiver

EMERSON 59—(Chassis DS-5)

Same Case Histories as listed for Emerson 39 receiver

EMERSON 101—(Chassis 6C, D6)

Same Case Histories as those listed for Emerson 34C and 102 receivers

EMERSON 102—(Chassis A8)

Inoperative, '80 tube blown or red hot	1)	filter condenser "shorted". Replace the entire filter block, using two 10-mfd. 600-v units
Inoperative (model 102 AC-DC receivers), Chassis smoking	1)	25A6 power amplifier tube faulty

(Cont'd)

EMERSON 102—(Chassis A8)—*(Cont'd)*

Weak reception, Weak and distorted reception	1)	for these troubles in the 102 receiver see the Case Histories listed for the Emerson 104 receiver
Hum	1)	filter condenser capacity below normal. Replace the filter block, using two 10-mfd. 600-v. units
Intermittent reception	1)	check the 0.25-mfd. condenser by-passing the '75 tube plate circuit—connected with a *red* wire on the "high" side
Distortion	1)	faulty 7-section condenser block
	2)	"leaky" 0.1-mfd. audio coupling condenser

EMERSON 103—(Chassis F5)

Loud high-pitched audio whistle	1)	replace 33 tube grid circuit resistor with one of different value that will just stop the whistle (one of about a few hundred ohms should do)

EMERSON 104—(Chassis A8)

Weak reception	1)	check the phono-pickup tip-jack to see if the "shorting" member has shifted out of position
Weak, Distorted	1)	leaky 0.01-mfd. coupling condenser between the plate of the '75 tube and the grid of one of the '6F6 tubes. This condenser is part of a block located on the side wall of the chassis
	2)	if foregoing condenser is O.K., check loudspeaker for a grounded and partially shorted voice coil
	3)	faulty unit in 7-section condenser block
Intermittent reception	1)	check the 0.25-mfd. condenser by-passing the '75 tube plate circuit—connected with a *red* wire on the "high" side

EMERSON 106—(Chassis U6B)

Inoperative, Weak reception	1)	check 0.1-mfd. 25Z5 plate-to-cathode by-pass condenser
	2)	check 0.1-mfd. (*C-7*) 6A7 tube screen by-pass condenser
Hum, Poor tone	1)	replace filter condenser block

EMERSON J106—(Chassis J)

Same Case History as that listed for Emerson 38 receiver

EMERSON 107—(Chassis U6A)

Inoperative	1)	"shorted" electrolytic condenser
Intermittent operation, Distortion	1)	"leaky" 4-mfd. 150-v. electrolytic condenser across speaker field
	2)	loose wire on coils
	3)	faulty condenser at cathode of 25Z5 (blue lead going into small condenser block can). Replace with an 8-mfd. 175-v unit
Poor tone, Hum, Distortion	1)	replace filter condenser block
	2)	replace coupling condenser

EMERSON 107AC—(Chassis E5)

Inoperative	1)	"open" 100-ohm resistor in B+ circuit

EMERSON 108 (Chassis U5A)

Weak reception, Distortion — 1) faulty 8-16 mfd. electrolytic condensers

Distortion — 1) increased value (carbonized) plate resistor

Hum — 1) 20- or 40-ohm pilot light resistor lugs "shorted" to volume control lugs

Hum — 1) if filter condensers, rectifier tube, etc. check O.K., look for a "ground" between the pilot light resistor and the chassis. Replace with a 25-ohm, 10-watt wire-wound resistor well insulated from the chassis

Hum when volume control is increased — 1) separate the connections to the two diode plates. Use one diode for detection. Connect the other to the cathode

Noisy reception — 1) faulty oscillator coil

Code interfer. — 1) "open" wave trap

EMERSON AD-108 (Chassis AD)

Distortion — 1) diodes of 6Q7 tube unbalanced

EMERSON 109

Tunable hum — 1) condenser from rectifier plates to chassis open. Replace with 400-volt condensers

EMERSON 110 (Chassis U5A)

Same Case Histories as listed for Emerson 108 receiver

EMERSON AD-110 (Chassis AD)

Same Case Histories as listed for Emerson AD-108 receiver

EMERSON 111—(Chassis U6A)

Same Case Histories as those listed for Emerson 107 receiver

EMERSON 112—(Chassis A8)

Same Case Histories as those listed for Emerson 102 receiver

EMERSON 114—(Chassis E5)

Same Case Histories as those listed for Emerson 107 AC receiver

EMERSON 116—(Chassis G5)

Inoperative over part of broadcast band — 1) replace 6D6 mixer-oscillator tube with a 6C6 which will function properly over the full band

EMERSON K116—(Chassis K)

Tuning condensers do not rotate when tuning knob is turned — 1) remove chassis from cabinet. Inspect the tuning belt. If it is O.K., slip the spring off the bracket. Bend spring carefully with pliers so that when replaced it pushes pulley more firmly against belt

EMERSON 117—(Chassis C5)

Inoperative — 1) "open" oscillator coil

EMERSON 118, 120—(Chassis U4B)

Weak reception — 1) faulty filter condenser. Replace block
2) "shorted" primary of antenna coil. The resistance of this coil should be 10 to 15 ohms
3) "open" or "shorted" primary of r-f coil

Distortion — 1) in early models 0.5-megohm resistor in screen circuit of 6C6 tube increases to as much as 2.0 megs. after use. Replace it

EMERSON 121—(Chassis G-5)

Same Case History as that listed for Emerson 116 receiver

EMERSON K121, K123—(Chassis K)

Same Case History as that listed for Emerson K116 receiver

EMERSON AD125—(Chassis AD)

Same Case History as that listed for Emerson AD108 receiver

EMERSON 126—(Chassis U4B)

Same Case History as that listed for Emerson 118 receiver

EMERSON A130—(Chassis A)

Dial light flickers — 1) faulty 43 tube
2) faulty ballast resistor

EMERSON B131—(Chassis B)

Inoperative — 1) "open" 230-ohm resistor in B-return. This is the bias resistor for the output tube and burns out due to a shorted terminal in second i-f coil. Repair this before replacing the resistor

Hum at resonance — 1) poor ground being used with receiver. If possible, make a good ground connection to a cold-water pipe

EMERSON C134—(Chassis C)

Production changes for improved performance — 1) the 0.01-mfd. condenser *No. 55* which was connected across the primary of the output transformer, is now connected from the 6L6 output tube plate to ground
2) short-wave antenna and detector coil trimmers *C6* and *C9* are mounted on their respective coils. *C6* is connected directly across the secondary of the short-wave antenna coil (*T3*), and is not returned to ground

EMERSON D134, D136, D138, D139, D140, D142—(Chassis D)

No AVC action — 1) fidelity switch "shorts" to grid of "magic eye" tube, leaving AVC action open

Distortion — 1) faulty 6F6 tube

Noise — 1) replace condenser out of which wax has melted. Separate the bleeder resistor from this condenser so the heat radiated from the resistor will not damage the replacement unit

Production changes for improved performance — 1) in receivers bearing serial numbers *below* 850,000, connect a 15,000-ohm ¼-watt resistor from the tap on the volume control to ground
2) in receivers bearing serial numbers *below* 864,755 change resistor *R-20* (connected from 6C5 phase inverter cathode to ground) from 5,000 ohms to 10,000

EMERSON L143—(Chassis L)

Inoperative — 1) "open" oscillator coil

Intermittent short-wave reception — 1) poorly-soldered connections on the short-wave coils. Resolder all the connections on these coils securely

EMERSON D146—(Chassis D)

Same Case History as that listed for Emerson D134 receiver

EMERSON Q157—(Chassis Q)

Whistling	1)	add a 0.1-mfd. condenser from electrolytic condenser to ground
Improving volume and bass response	1)	shunt a 5 to 25-mfd. 35-volt electrolytic condenser across the 25L6G cathode resistor (a small rectangular *black* unit mounted directly underneath the 25L6G socket). Connect condenser *positive* to cathode and *negative* to chassis

EMERSON R152, R153, R156, R158, R167—(Chassis R)

Weak reception	1)	"shorted" primary in antenna coil
Distortion	1)	"open" 10-megohm resistor (*R-8* on circuit diagram)
	2)	"open" 5-megohm resistor in grid circuit of '75 tube (*R-5* in circuit diagram)
	3)	faulty audio coupling condenser
Noisy reception	1)	faulty oscillator coil

EMERSON AF171—(Chassis AF)

Production change for improved performance	1)	in receivers bearing serial numbers *below* 1,244,716 remove the 0.25-mfd. condenser *C-17* connected between the negative side of the filament and ground. Ground this side of the filament to chassis instead

EMERSON R189—(Chassis R)

Same Case History as that listed for Emerson R152 receiver

EMERSON AX211, AX212, AX217, AX219, AX221——(Chassis AX)

Inoperative	1)	"shorted" dual filter condensers (causing 25Z6GT rectifier cathode leads to "blow")
Intermittent reception, Weak	1)	inspect antenna coil (large black coil at rear of chassis. Ground end of lug and coil soldered to chassis. This lead often breaks

EMERSON BW 231

Hum after operating a while	1)	poor electrical connection in terminal strip mounted on back underside flap of chassis. Resolder

EMERSON AX240—(Chassis AX)

Same Case History as that listed for Emerson AX 211 receiver

EMERSON EC 242

Weak reception	1)	if replacements of any parts are made, or the wiring disturbed in the r-f amplifier portion of the circuit, the receiver should be carefully realigned

EMERSON 250—(Chassis H5)

Intermittent reception	1)	check the dry electrolytic filter condensers. There are two condensers in a single case (the one on top when the chassis is upside down) having values of 8 and 16 mfd. Use a factory replacement to fit into the small space available
	2)	if the foregoing condensers break down, the 25Z5 tube is likely to be damaged and should be replaced
Weak reception	1)	check the voltage on the speaker field. Low or no voltage is likely due to a faulty section in the 25Z5 rectifier or filter condenser which shunts the speaker field. To get at this condenser, the receiver filter condenser must be unscreened and pulled out

(Cont'd)

EMERSON 250—(Chassis H5)—*(Cont'd)*

Distortion	1)	try another 43 power tube. As the circuit is critical in this respect an especially good tube must be used here or distortion will appear at irregular intervals
Hum	1)	filament resistor (mounted on the chassis) "shorting" against metal container. Replace the resistor, or insulate it from the metal

EMERSON 250 AW

Same Case History as that listed for Emerson 30 AW receiver

EMERSON CU 265

Dial light and 2 or 3 tubes burn out	1)	two adjacent filament prongs in sockets touching each other and "shorting" out these tubes

EMERSON EC 296

Same Case History as that listed for Emerson EC 242 receiver

EMERSON 300—(Chassis H5)

Same Case History as that listed for Emerson 30 receiver

EMERSON EC 301

Same Case History as that listed for Emerson EC 242 receiver

EMERSON DJ 310

Inoperative on a-c side	1)	if only the 70L7 tube lights, check for "open" filter choke

EMERSON CV 313

Dial slips repeatedly	1)	slightly roughen surface of shaft on which cord slips (use fine emery cloth), and apply powered rosin, rubbing in well. Clean ball bearing of tuning condenser with carbon tetrachloride. Then apply a light oil to bearing

EMERSON EC 314, EC 315, EC 327

Same Case History as that listed for Emerson EC 242 receiver

EMERSON 321 AW, 330 AW

Same Case History as that listed for Emerson 30 AW receiver

EMERSON DM 331

Inoperative on broadcast band but O.K. on s.w.	1)	"open" broadcast band oscillator grid coil (this coil is in series with short wave section)
Intermittent reception, blinking dial light	1)	check for break in ballast

EMERSON DP 332

Weak reception, Only "locals" received at ½-vol. setting	1)	replace 500,000-ohm volume control

EMERSON 336

Distortion	1)	(only about 50 volts on 50LGT plate, and 10 volts *positive* on control grid). "shorted" or "leaky" grid coupling condenser

EMERSON EC 336

Same Case History as that listed for Emerson EC 242 receiver

EMERSON 338

Weak reception	1)	volume control shaft "shorts" to ground

EMERSON EC 347

Same Case History as that listed for Emerson EC 242 receiver

EMERSON 350 AW

Same Case History as that listed for Emerson 30 AW receiver

EMERSON EC 353, EC 366

Same Case History as that listed for Emerson EC 242 receiver

EMERSON ER 369, ER 370—(Chassis ER)

No sound when phono pickup needle is on moving record
1) "muting" switch out of adjustment. The contacts of this switch should be "open" whenever its long blade is not resting on shoe of "engagement clutch cam assembly." If the contacts remain closed after the long blade has left the shoe, they should be adjusted by bending until there is a separation of approx. 1/32 inch. Switch should now be checked to make sure contacts are "closed" when long blade is resting on shoe of the engagement clutch cam assembly
2) lugs on "muting switch" bent and "shorting" to each other
3) pickup cartridge in tone arm damaged or faulty

EMERSON DZ 371

See also Case History listed for Emerson ER 369

Poor recordings
1) threads from record cuttings getting down onto Rubber Idler Drive Wheel and between drive wheel and motor pulley. This will cause very bad speed variation of the turntable and, of course, will result in very inferior recording. Cuttings may also wrap around motor shaft and cause motor to slow down or stop

To remove the record cuttings, the turntable should be lifted by applying an even lifting force at opposite edges of the turntable while the turntable spindle is gently tapped downward on its top end, and the record cuttings then removed. The Rubber Idler Drive wheel should be taken off; this can be accomplished by unsnapping the small snap cotter ring and slipping Rubber Idler Drive Wheel off its shaft, after which all record cuttings can be removed

Note: No grease or oil should get on surface of Rubber Idler Drive Wheel

EMERSON EC 376

Same Case History as that listed for Emerson EC 242 receiver

EMERSON 397 (Automatic Record Changer)

Tone arm lands only on 10" records
1) check automatic record setting lever (the lever that is struck by 12" records when they drop). Directly below this lever (on the underside of the panel) is a bronze spring about ¾" long that often drops from the panel, causing this trouble. Replace with new type Emerson replacement spring that cannot fall off

EMERSON 409, 410, 411 ("Mickey Mouse")—(Chassis A4)

Hum
1) connect a high-capacity condenser between one side of the line and the chassis. Change the position of the 0.0001-mfd. coupling condenser, placing it where the hum is least audible while the receiver is in operation

(Cont'd)

EMERSON 409, 410, 411 ("Mickey Mouse")—(Chassis A4) —*(Cont'd)*

Whistling and "motorboating" when volume control is turned up
1) replace entire filter condenser block

Weak, distorted reception
1) faulty 500,000-ohm resistor connected to 6F7 pentode plate. Replace

EMERSON 420—(Chassis V4)

Insensitive, Low volume on low frequencies (tubes and voltages test O.K.)
1) faulty antenna pickup coil. Move coil either up or down over secondary of first tuned r-f stage until the most satisfactory result is obtained, then cement the coil in that position
2) antenna and interstage circuits out of alignment

EMERSON EC 425

Same Case History as that listed for Emerson EC 242 receiver

ERLA

ERLA, BRANDES

Intermittent reception
1) faulty local-distance switch. Contact material becomes loose in the spring. Put the contact piece back in the tapered hole, and carefully centerpunch around the edge to tighten it in place

ERLA-SENTINEL 60BT

Volume low (all voltages check O.K.)
1) partial "short" in volume control. Center terminal tests about 500-ohms leakage to ground. Replace the unit—even if it tests apparently O.K.

ERLA 224 A-C

Intermittent reception
1) faulty local-distance switch. To repair, put the contact in a tapered hole and centerpunch around the edge to retighten. As this is a single-pole double-throw switch, it may easily be replaced by any similar type having the mechanical requirements to fit the receiver mounting

Distortion (high plate current in 45 tubes)
1) check the two resistors connected in series across the speaker field. The one which connects, at one end, to the centertap of the high voltage winding should have a value of 6,000 ohms. The one with the 0.5-mfd. condenser across it and which has one end grounded should have a value of 10,000 ohms

Hum
Severe hum modulation and distortion (accompanied by no grid bias, high plate current, and low plate voltage on the '45 tubes, and little or no speaker field excitation)
1) remove speaker plug and check the resistance across the two right-hand terminals on the terminal strip of the receiver. If a low resistance (or a "short") is indicated, the 1-mfd. section in the condenser block is probably "shorted". Test it (this section is connected between the high-voltage centertap on the power transformer and the "high" side of the speaker field). Two other filter condensers, of 2- and 3-mfd. respectively, have their common negative connected to the "high" side of the foregoing condenser. Lift the terminal strip on the old block; remove the leads to the three condensers, and connect new condensers externally in their place

ERLA 6200, 7700

Whistling or squealing	1)	replace 0.01-mfd. grid-return by-pass condenser with a 0.02-mfd. unit
Poor tone quality in model 6200	1)	install a filter composed of a 0.005-mfd. condenser in series with a 10,000-ohm resistor from plate to ground on the last audio tube

ESPEY

ESPEY "Mystic Record"

Whistling, howling when microphone is used	1)	shift alignment to about 900 kc. This tightens the padder condenser and eliminates vibration of its plates

EVEREADY

EVEREADY 1, 2, 3

Inoperative, Weak (no plate voltage on r-f tubes)	1)	large Pyrohm resistor in *B*-lead of r-f tubes "open"
Intermittent reception	1)	loose lug on front of first condenser stator section
	2)	variometer connection lead short-circuiting to chassis
Weak reception, Distortion	1)	open-circuited 50,000-ohm detector plate supply resistor
Noisy reception	1)	noisy 50,000-ohm detector plate supply resistor
	2)	noisy primary winding of a-f transformer
"Put-put" Whistling, (motorboating) sound	1)	connect additional 1-mfd. by-pass condensers from either side of detector plate supply resistor to chassis
Hum at resonance	1)	supply line by-pass condenser open-circuited

EVEREADY 30, 40

Intermittent reception	1)	intermittently open-circuiting winding on speaker voice coil, opening with the vibration of the speaker. Rewind or replace the voice coil
Squealing at high volume level	1)	check line voltage. Should not be over 110 volts
	2)	if line voltage is O.K., adjust variometer on end of condenser gang shaft for no oscillation by loosening mounting screws and turning its stator

EVEREADY 42, 43, 44

Weak reception, Distortion	1)	"open" 1,750-ohm cathode bias resistor for '27 first-audio tube. Use 1-watt replacement unit
No control of volume	1)	"open" 3,500-ohm resistor which bleeds current through volume control from point where r-f tubes obtain plate voltage. Use 10-watt replacement unit

EVEREADY SERIES 50

Inoperative, Weak	1)	check the small mica condensers around the '27 first a-f tube and '27 detector, for "shorts"
	2)	check the plate by-pass condenser for the '24 tubes. Replace with 300-v. type
	3)	faulty or dirty contacts in phone switch. This switch is accessible at the back of the chassis, and is automatically actuated when the tuning condenser dial is turned in the low-frequency position or the "phono" position. To obtain good contact it may be necessary to bend the switch blades until they open and close properly
Hum	1)	adjust the set-screw hum-control adjustment located at back of chassis. The control consists of a low resistor connected across the heater winding
High-resistance section of dual volume control burns out or goes bad mechanically	1)	substitute a 50,000- or 75,000-ohm, 2-watt fixed resistor for the defective section. Replacement of complete unit is unnecessary
"Put-put" (motorboating) sound at high volume	1)	check the screen-grid voltage divider. Replace with a 20-watt wire-wound unit if necessary

EVEREADY 52

See also all Case Histories listed for Eveready 53, 54 receivers

Inoperative	1)	check the small mica condensers around the '27 tube first a-f, and '27 detector, for "shorts"
Weak signals (from 550 to about 700 kc)	1)	check copper contactors in condenser gang, for "corroded" contacts
	2)	check coupler coil on end of condenser gang, for poor contact
	3)	check coupler coil, for adjustment
AC hum (intermittent, or continuous)	1)	the common ground-return of the filter condenser block makes poor contact with the can. This wire is found just inside the end of the can where the cover is soldered to the tin box

EVEREADY 53, 54

Inoperative (no detector plate voltage)	1)	"open" in the detector plate load caused by poor contact in the phono-radio switch. This switch is fitted to the frame of the tuning condenser, near the dial, and is operated by a lever on it. Switch is easily accessible from the rear of the chassis
Weak reception	1)	control shafts short-circuiting to metal panel
Weak reception at high or low frequencies	1)	variometer out of adjustment
Noisy tuning, Squealing	1)	corroded variometer rotor contact
Noisy reception	1)	noisy 0.001-mfd. detector plate by-pass condenser
Hum	1)	add filter condenser from either side of speaker field to chassis
	2)	short-circuited choke "tuning" condenser
High plate current	1)	open-circuited grid suppressors

FADA

FADA "Old Models"

Slipping dial on early models having separate driving drum	1)	loosen set-screws and give drum half a turn so as to bring unused portion around for use. Tighten set-screws

FADA A.C.-D.C. MODELS

Inoperative	1)	faulty ballast resistor, or faulty 196-ohm filament resistor tapped at two 88-ohm sections for pilot light bulbs
	2)	faulty tube
Hum, Distortion	1)	filter condensers below normal capacity

FADA RA Chassis

Inoperative	1)	faulty a-f input transformer
Weak reception (voltages O.K.)	1)	try another '56 oscillator tube
Continuous noise like "static"	1)	"noisy" primary of push-pull transformer. Replace the transformer—or install resistance-coupling instead. Disconnect the primary, and couple with a 25,000- or 50,000-ohm resistor and 0.01-mfd. condenser from the plate of the '56 tube to the grid of the '47 tube
Noisy volume control	1)	first try a new '56 tube in the first a-f socket. If this does not help, replace the volume control

FADA 5F60

Howling intermittently	1)	move 25L6 tube plate lead away from the 6C6 grid lead. Shield lead if necessary
	2)	check for "open" by-pass condenser in 25L6 plate circuit
Howling, Hum, Distortion	1)	faulty filter condenser section

FADA 10, 11

No reception, (low "B" voltage, or no r-f plate voltage)	1)	short-circuited filter condenser in block
	2)	short-circuited r-f by-pass condenser
Inoperative, Weak reception	1)	shorted or grounded lugs of r-f coils
	2)	readjust balancing condensers
Noisy reception,	1)	noisy first or second a-f transformer primary
Loud hum, Poor tone	1)	due to electromagnetic interaction between the first a-f transformer and the power transformer or filter chokes. Substitute a type '56 tube for the type '27 detector tube and "short" the grid leak and condenser. Insert a 30,000-ohm resistor, shunted by a 1-mfd. condenser between the detector tube cathode and ground. Remove the first a-f transformer and substitute in its place resistance-capacity coupling
	2)	pilot-light socket "shorting" to chassis
	3)	pilot-light socket lug short-circuiting to chassis
Pitch melts out from power transformer	1)	caused by heat generated by type '80 tube situated close to the transformer. Place a piece of asbestos board between the tube and transformer

FADA 15

Inoperative, Weak reception	1)	lugs of r-f coils shorted or grounded to chassis. Inspect these points—trouble will not show up on an analyzer if trouble is in grid circuit

FADA 16, 17, 20

No reception, (no plate voltage)	1)	short-circuited filter condenser in block
	2)	short-circuited by-pass condenser
Inoperative, Weak reception	1)	lugs of r-f coils shorted or grounded to chassis
Noisy reception	1)	noisy first a-f transformer primary
Intermittent reception, Squealing	1)	open-circuiting cathode or plate by-pass condenser (block)
Fading	1)	noisy volume control. Replace with new unit
Weak reception	1)	readjust balancing condensers

FADA 25, 25-Z

No reception, (no plate voltage)	1)	short-circuited filter condenser in block
	2)	short-circuited by-pass condenser
Inoperative, Weak reception	1)	r-f coil lugs short-circuiting or grounding to chassis
Intermittent reception	1)	defective tinsel speaker cord
	2)	poor connection of speaker tinsel cord to phone tips
	3)	faulty volume control. Replace
Intermittent reception, Squealing,	1)	open-circuiting r-f cathode or plate by-pass condenser block
Weak reception	1)	readjust balancing condensers
	2)	defective 0.001-mfd. by-pass condenser between the plate and cathode of the type '27 detector tube. Replace
Weak, Poor tone	1)	replace the 0.25-mfd. 400-volt condenser (from "ground" to the *green* resistor at the bottom center of the chassis) with an 8-mfd. electrolytic unit
Fading	1)	noisy volume control. Replace
Hum, Distortion	1)	open-circuited filter condenser (possibly caused by loosened nut which holds the common condenser terminal)
	2)	poor grounding of condenser block
	3)	"shorted" filter condenser block leads
	4)	pilot light socket "shorting" to chassis
	5)	pilot light lug short-circuiting to chassis
	6)	remove the 0.00025-mfd. condenser connected across the push-pull input of the second audio stage. Replace it with a 0.005 to 0.01-mfd. unit
Noisy reception	1)	noisy a-f transformer primaries
	2)	tube and circuit noises can be materially reduced by shunting each of the grids of the power tubes to the chassis with 50,000-ohm 1-watt resistors
"Frying" noise	1)	replace the first audio transformer
	2)	reverse the a-c line plug. One side causes more hum than the other
Volume control inoperative	1)	20,000-ohm *green* resistor "grounding"
Slipping dial	1)	check clearance between dial drum and volume control
	2)	pour some finely-powdered rosin between the disc and the engaging drum on the driving mechanism

FADA M-25 (Using 15C speaker)

Excessive hum	1)	open No. 6 section in filter block

FADA 30, 31

Same Case Histories as those listed for Fada 10, 11

FADA 32

Same Case Histories as those listed for Fada 16, 17, 20

FADA 35, 35B

Inoperative, Weak reception	1)	r-f coil lugs short-circuiting or grounding to chassis
Intermittent reception	1)	open-circuiting r-f cathode or plate by-pass condenser (block)
	2)	defective tinsel speaker cord
	3)	corroded contact arms of double volume control
	4)	poor connection of speaker tinsel cord to phone tips
Squealing	1)	open-circuiting r-f cathode or plate by-pass condenser
Hum	1)	open-circuited filter condenser (possibly caused by loosened nut which holds the common condenser terminal)
	2)	poor grounding of condenser block
	3)	short-circuited filter condenser block leads—rubber insulation cracked
	4)	the circuit in this receiver is quite critical as regards the rectifier tube. See that is in good condition. Also see that the '45 power tubes are well matched
	5)	either "shorted" or badly leaking 0.15-mfd. condenser in power unit connected across speaker field
Hum, Distortion	1)	pilot-light socket short-circuiting to chassis
Slipping dial drive	1)	careful examination will show bracket casting holding friction drive to be warped; this will prevent the friction drive from gripping the large drum. (The only solution is to replace bracket casting marked 872MP)
Noisy reception	1)	first a-f transformer "noisy" (replace)

FADA KA-41

Inoperative	1)	0.01-mfd. audio coupling cond. "shorted"
Intermittent reception, Fading	1)	open-circuiting r-f secondary windings (leads snapped at lug)
	2)	0.01-mfd. audio coupling cond. "open"
Hum	1)	open-circuited 0.5-mfd. detector amplifier cathode by-pass condenser. Try connecting a 25-mfd. 25-volt electrolytic condenser in its place
	2)	poor cathode-heater insulation of type '27 tubes
Distorted, Weak reception	1)	leaky 0.01-mfd. audio coupling condenser
	2)	"gassy" 27 a-f tubes

FADA KA-42

Weak, insensitive	1)	if detector plate voltage is slightly lower than normal value, replace the 50,000-ohm resistor in the plate circuit with one of lower resistance (about 40,000 ohms). Replacing detector tube may also help
Intermittent reception	1)	replace both 0.01-mfd. coupling condensers
Fading	2)	faulty r-f plate by-pass condenser (located in the gang-condenser housing—the one with the red lead going to the r-f coil is usually the faulty one)
	3)	check both the phono switch and the local-distance switch contacts

(Cont'd)

FADA KA-42—*(Cont'd)*

Flicker in Flashograph pilot	1)	clean the contacts of the spring switch located behind the small panel and below the tuning dial
Squealing, Motorboating	1)	connect a 0.01-mfd. condenser between one side of the 110-v. line and the chassis. (Try each side of line, in turn)
Distorted reception	1)	"shorted" or "leaky" No. 5 section in filter block (two *blue* leads)
	2)	"gassy" 27 a-f tubes
Hum	1)	connect a 25-mfd. 25-volt electrolytic condenser across present 0.5-mfd. condenser in cathode circuit of detector-amplifier stage

FADA KF-43

See also Case Histories listed for Fada KA-41 receiver

Noisy reception	1)	noisy primary in push-pull input transformer
Distortion	1)	lowering in value of 125,000-ohm resistor connected from screen-grid to chassis. Replace

FADA KA-44

Distorted reception	1)	"shorted" or "leaky" No. 5 section in filter block (two blue leads)
	2)	"gassy" '27 a-f tubes
Hum	1)	connect a 25-mfd. 25-volt electrolytic condenser across present 0.5-mfd. condenser in cathode circuit of detector-amplifier stage

FADA KU-45, KU-45Z

Poor control of volume (at low volume)	1)	remove old volume control, installing new 15,000-ohm control with taper for antenna and cathode bias. Ground the center arm of the new control. Left arm goes to antenna post; right arm goes to cathode bias resistor. Now ground the old wire leading from screen series resistor through a 5,000 to 8,000-ohm 2-watt resistor
Noisy reception	1)	bad contact on tone-control switch. Replace with variable resistor type. If receiver is "noisy" when turning station selector knob clean wiper contact springs on ganged variable condenser. If noise is of a high level check 0.003-mfd. mica condenser in plate circuit of 2nd detector stage
Distortion at low volume	1)	voice coil tubing may be warped, thereby rubbing on speaker pole. Try to re-center. Replacement of complete cone assembly is advisable
Intermittent distortion	1)	intermittent high-resistance short-circuit between the primary and secondary of the input push-pull transformer. Replace with a new unit

FADA KA-46, KA-47

Same Case History as that listed for Fada KA-44 receiver

FADA 48

Low volume, Audio howling, (set plays when test prod is placed on plate terminal of second i-f tube)	1)	poor contact between resistance element and movable arm on volume control, causing an increase in the value of the AVC circuit resistance, thus making it over-effective and causing a decrease in volume. Adjust the arm so it will make good contact

(Cont'd)

FADA 48—*(Cont'd)*

Whistling, Howling, Fading	1)	"leaky" by-pass condensers. Test for, and replace, all faulty units
Flashograph tube lights only on very strong signals	1)	shunt the 1-mfd. condenser from the one side of the Flashograph, and turn the control to the end
Aligning the receiver	1)	the four i-f tuning condensers are located at the rear of the chassis, while the oscillator trimmer is lo located between the '47 output and the 35 tubes in the main shield housing

FADA KW-48

Fading, Squealing, Howling	1)	check all by-pass condensers, testing all of them with about 600 volts. Use 600-volt replacement units
	2)	shield the first r-f tube with an ordinary tube shield. To do this, remove the small metal partition near the tube. Then realign the receiver

FADA 49

Low volume, Audio howling, (set plays when test prod is placed on plate terminal of second i-f tube)	1)	poor contact between resistance element and movable arm on volume control, causing an increase in the value of the AVC circuit resistance, thus making it over-effective and causing a decrease in volume. Adjust arm for good contact
Fading, Howling, Squealing	1)	replace "open" or "leaky" first-detector cathode by-pass condenser. Check all other by-pass condensers
Fading accompanied by "frying" noise	1)	replace push-pull input transformer
Aligning the receiver	1)	the four i-f tuning condensers are located at the rear of the chassis, while the oscillator trimmer is located between the '47 output tube and the 35 tubes in the main shield housing

FADA KW-49

Same Case History as that listed for Fada KW-48 receiver

FADA 50

Same Case Histories as those listed for Fada 70, 71, 72 receivers

FADA KF-52

Whistling or squealing at the lower frequencies	1)	add a 10,000-ohm resistor across primary of the antenna coil

FADA F-55

High-pitched whistle	1)	install a grounded tube shield around the 12Q7GT tube
	2)	dress speaker leads away from 12Q7GT tube
	3)	shield grid lead of 12Q7GT if necessary, and ground the shield

FADA P-58, PL-58

Hum	1)	locate 25-mfd. by-pass condenser in the 70A7GT tube cathode circuit. This condenser is shunted across a 750-ohm resistor to ground. Replace it with a 50-mfd. unit. (This change has already been made in late production receivers)

FADA KA-60

Intermittent reception, Fading	1)	see Case History for this trouble listed under Fada KA-42 receiver

FADA KY-66

Squealing on one or more short-wave bands	1)	connect a 300-ohm, non-inductive resistor in series with the control-grid lead of the type '24A first detector-oscillator tube
Distortion	1)	"leaky" blocking condenser or coupling condenser between the first audio stage and the output
Squeals when tuning	1)	"open" bias condenser *No. 3-1271MS* located at one end of chassis

FADA 70, 71, 72

No reception	1)	short-circuited by-pass condenser located under variable condenser in shield can
	2)	open-circuited resistors in series with the plate voltage supplied to r-f coils
Intermittent reception, No reception	1)	broken leads on loop antenna
	2)	open resistor in power pack

FADA RK-100 Auto Radio

Ignition interference	1)	check leads from power unit to receiver. The metal shield which surrounds them should be grounded to car frame

FADA RK-101 (MOTOSET)

Shorted power transf.	1)	May be caused by contact points on minimum-voltage relay sticking. Clean and adjust points
Intermittent reception	1)	vibrator contacts corroded, (filing will only help temporarily, advise replacing the unit)
Noisy reception	1)	poor shielding of leads running from power unit to receiver. See that the metal sleeve is properly grounded to the car frame; it should be bonded at several points

FADA 90

Inoperative	1)	faulty a-f choke
	2)	"open" 6F5 1st a-f plate resistor
	3)	"leaky" 6F5 1st a-f 0.05-mfd. plate-to-grid coupling condenser
	4)	check for faulty 50,000-ohm plate resistor

FADA 211 AC-DC

Inoperative receiver (all tubes check O.K.)	1)	190-ohm (metal-tube style) ballast resistor "open"

FADA 350W

Weak reception	1)	"shorted" i-f padder located underneath the chassis (electrolytic condenser is mounted directly above this padder). Clean so as to clear "short"—then readjust

FADA 360

Weak reception	1)	inspect for bent or broken connection to primary of coupling transformer between antenna and 6A7 grid circuit

FADA (CANADIAN) W-452X

Distortion at low volume	1)	overloading in the r-f section. Remedy: slightly detune the first r-f stage

FADA KG-761, KG-762, KG-764, KG-766, KG-767

Fading, Intermittent reception	1)	open-circuiting r-f cathode by-pass condenser
	2)	open-circuiting r-f plate by-pass condenser
	3)	open-circuiting 0.5-mfd. screen by-pass condenser
Whistling, Distortion at any volume level	1)	open-circuited screen bleeder resistor connected from detector screen to chassis. This is a 125,000-ohm ½-watt carbon unit. Replace with metalized type unit
	2)	This same resistor changed to higher value. Replace with metalized type unit
Noisy reception	1)	noisy primary in input push-pull transformer

FAIRBANKS-MORSE

FAIRBANKS-MORSE CONSOLE MODELS

Reverberation, or acoustic feedback	1)	insert ¼-in. rubber grommets in the screw holes of the metal "tone-projector" baffle at the points where the speaker is bolted to it

FAIRBANKS-MORSE B6

Howling	1)	make sure that gang condenser floats freely on rubber mounting. If drive cable pushes too tightly against the gang condenser, free it

FAIRBANKS-MORSE 8A

Inoperative on broadcast band, O.K. on short waves	1)	faulty resistor mounted on 6C5G oscillator tube socket and connected to terminals *No. 1* and *No. 5*. Replace

FAIRBANKS-MORSE 9A

Oscillation	1)	add 100-ohm resistor in the grid circuit of the 6C5G oscillator tube in early-run receivers to prevent parasitic oscillations

FAIRBANKS-MORSE 12A

Increasing sensivity on the ultra-high frequency band	1)	change the 50-mmfd. condenser *No. 33* to a 100-mmfd. unit. This is in the grid circuit of the 6C5G oscillator

FAIRBANKS-MORSE 42, 42TI-B

"Put-put" (motorboating) sound when volume is advanced on strong stations	1)	check 8-mfd. condenser, or resistor, connected to volume control
To lengthen life of the "B" and "C" batteries	1)	locate and remove the 20,000-ohm ¼-watt resistor that is connected from minus 16½ volts C direct to ground. Leave it out of the circuit

FAIRBANKS-MORSE 56

Inoperative (oscillator "dead")	1)	corrosion around socket of 6A7 from electrolyte of wet filter condenser. Replace socket and clear up all possible leakage paths
Distortion (at high volume)	1)	leaky blocking condenser between 75 plate and 42 grid

FAIRBANKS-MORSE 346

Same Case History as that listed for Fairbanks-Morse B6

FARNSWORTH

FARNSWORTH P-2 Record Changer

Tone arm does not always land in same spot	1)	check for loose lever connecting tone arm to tone arm vertical shaft
Trips erratically	1)	see that trip finger does not interfere with release trip lever
	2)	check for excessive binding in friction trip assembly

FARNSWORTH AT-21

Noisy, crackling	1)	remove clamps holding filter condensers. These clamps are not needed

FARNSWORTH BT-22

Inoperative (all voltages and resistors normal)	1)	replace oscillator coil
Noisy when tuned	1)	replace oscillator coil

FARNSWORTH P-41 Automatic Record Changer

Records trip before end of record, Records do not trip at end of record	1)	check tripping mechanism; when phono needle is 1⅞" from center of record spindle the trip finger should trip the starting lever release trip. To adjust tension, loosen Bristol set screw in upper collar. Turn collar *counter clockwise* to increase friction (if changer does not trip at end of record) and clockwise to decrease friction (if changer trips before end of record). There should never be any more friction than is necessary to move starting lever release trip off the end of the starting lever
Lubricating the mechanism	1)	about every six months, or once each year, two or three drops of oil should be put on the two felt washers in the spindle gear bracket. One washer is located at the bottom of the spindle gear, the other is at the top of the bracket and is accessible by removing the turntable. Put two or three drops of oil on the pin for the roller of the tone arm lift lever. A very light application of white vaseline on the teeth of the main cam, also some on the face on this cam where the tone arm swing lever rides. A single drop of oil on the 10" and 12" plungers. Care should be exercised to prevent an excess of oil being used on any part No further lubrication on the tone arm bearing will be necessary unless a replacement is made. In this case a thin film of vaseline may be used Care should be taken to see that no oil gets on the motor pulley, idler pulley or rim of the turntable. No oil should be used on the friction trip assembly Use only a good grade of machine oil with a viscosity of SAE 10

FARNSWORTH SM-41 De Luxe Automatic Record Changer

Mechanism slow in starting, Motor gets hot	1)	check lubrication. Oil if necessary (see lubrication instructions which follow later)
	2)	check for abnormally high or low line voltage
	3)	check for damaged motor windings. If damaged, remove motor for repair or replacement
Motor fails to run (even when entirely disconnected from other wiring and proper voltage is applied directly to the two ends of its windings)	1)	trouble in motor windings. Inspect, test
Motor slow in starting	1)	if changer has been in very cold place, give it fair chance to get warmed up before concluding that motor is faulty and proceeding as in paragraph above
Squeaks, noises during playing of records	1)	check oiling (see lubrication instructions listed here later)
	2)	check to see that records in stack are centered on rotating spindle and not rubbing excessively against it. Do this by running turntable with, and without, a load of records. Rub a little wax on turntable spindle
	3	check for bent spindle by seeing if it runs true when no records are in stack
Changer noisy when cycling	1)	check oiling
	2)	see if any part has become loose or bent and is rubbing against a moving part
Motion of pick-up toward turntable spindle does not trip changer mechanism	1)	see that control switch-pointer is not set on "M" (*Manual Playing*)
Pressing push-button does not trip changer mechanism	1)	see that control switch pointer is not set on "M" (*Manual Playing*)
	2)	check control switch assembly for an obstruction or a bent or loose part. Also check for loose set-screws in switch knob
	3	follow through on action from the push button to switch latch and see that every part is operating properly
Setting pointer on "M" (manual) fails to put changer mechanism out of action so as to enable *Manual* operation	1)	check for loose set-screw in control switch knob
	2)	also check for loose or bent parts and be sure that manual latch is holding the trip link rod to keep it from moving
Tone arm falls off record	1)	needle lands too close to edge of record. Not adjusted in far enough. Check landing adjustment by inserting screwdriver through needle landing adjusting hole just back of tone arm. For adjusting needle landing on a 10" record, insert screwdriver into slot in 10" adjusting stud (inner one). For adjusting the needle landing on a 12" record, insert it into the slot in 12" adjusting stud (outer one). Turn very slightly clockwise or counterclocwise to move needle

(Cont'd)

FARNSWORTH SM-41 De Luxe Automatic Record Changer —(*Cont'd*)

Tone arm falls off record (*Cont'd.*)		landing in or out. The factory adjustment of the needle landing is ⅛" in from outer edge of record
Tone arm varies when set down on record	1)	check for loose clamp screw in tone arm shaft head. It may be loose on the tone arm shaft
	2)	be sure that stop lever engages the eccentric adjusting cams for both 10" and 12", holding them securely until needle has landed on record (check cam adjustment)
Tone arm lands too far in or out on record	1)	due to not measuring properly in adjustment specified above
	2)	if tone arm lands in middle of record and unit continues cycling check the cam adjustment
Needle lands properly on record, but fails to slide over into record starting groove	1)	pickup cord may be restricting movement of arm at back end, binding its action
	2)	check the cam adjustment
Needle lands properly on record but slides in on record	1)	no needle in pickup cartridge
	2)	broken permanent sapphire point in LP type cartridge. (Entire cartridge must be replaced since sapphire is an integral part of the cartridge and cannot be removed without damaging the cartridge. Needles can only be replaced in cartridges having a needle screw)
Changer continues cycling	1)	probably no clearance between hook end on trip lever, and lug on intermediate gear due to being bent. Straighten, if possible, or replace with new trip lever
Motor continues operating	1)	mercury switch out of level due to changer cabinet standing at an angle. Adjust mercury switch by slightly loosening holding screws, adjust switch bracket, tighten screws
Record driven O.K. but heard weakly or not at all	1)	pickup cord not properly plugged in
	2)	check amplifier and speaker and connections to them
	3)	check pickup cartridge, and replace with new one if faulty
Record jams	1)	check records for being off-size or having faulty edge. Records should have a uniform semi-circular edge which can be successfully handled by the record changer even though records vary considerably in thickness. If edge shape is irregular, grooved, or has a projecting fin, round up the edges with a piece of fine sand paper or emery clotoh
	2)	if changer plates need adjustment, check them and make necessary adjustment
Turntable tight	1)	turntable is assembled to turntable spindle cone with a taper lock fit in center. To remove turntable, grasp with both hands, at the same time pulling upward while it is revolving
Motor rumble heard in record reproduction	1)	shipping screw not removed from motor
	2)	motor leads may be pulled too tight, not allowing motor to float properly
Lubrication	1)	Do *not* oil felt washers on the two idler wheels
	2)	check the two oil wicks on motor to see that they are thoroughly saturated
	3)	check lubrication on turntable spindle

(Cont'd over)

FARNSWORTH SM-41 De Luxe Automatic Record Changer —(Cont'd)

Lubrication (Cont'd.)		bearings. Oil top bearings by removing turntable (when replacing it be careful not to injure rubber idler wheels). Then oil lower bearings from below
	4)	check lubrication at all other bearing points

FARNSWORTH ATL-50

Weak reception on short waves	1)	realign receiver at 15 mc
Hum (steady and loud)	1)	try moving 15-mfd. electrolytic condenser *No. 30* about one inch away from the spring shielding on the radio-phono leads. The lead of the condenser will have to be lengthened to do this
Modulation hum	1)	connect a 0.25-mfd. condenser from rectifier cathode to chassis

FARNSWORTH CT-51

Pilot light burns out	1)	check to see if part of the series resistor is being shorted out by solder shorting the filament circuit to ground. If pilot light burns out, replace it immediately to prevent damage to the other tubes in the set—especially to 35Z5GT. Check all tubes

FARNSWORTH BT-52, BT-53, BT-54 receivers

Circuit change for improved performance	1)	remove 100-ohm resistor now connected in the primary circuit of the 2nd i-f transformer. Connect it instead in the 12SA7 (osc.-mod.) plate and screen circuit *combined* return lead to B plus. The 0.05-mfd. by-pass condenser in this circuit should be connected between ground and the *plate* end of this resistor

FARNSWORTH CT-54

Same Case History as that listed for Farnsworth CT-51 receiver

FARNSWORTH BT-55, BT-56

Same Case History as that listed for Farnsworth BT-52 receiver

FARNSWORTH ATL-59

Hum (louder on phono than on radio)	1)	dress radio-phono leads further away from line cord to reduce inductive pick-up from it
Electric shock when phono pickup arm is touched	1)	break the shield on the wire which connects the receiver chassis and phono pickup arm and insert a 0.1-mfd. condenser in it

FARNSWORTH CT-61, CT-64

Same Case History as that listed for Farnsworth CT-51 receiver

FARNSWORTH AC-70

See also Case History listed for Farnsworth AC-71 receiver

Inoperative	1)	check cathode resistor of output tube. Replace
	2)	check for "shorted" 0.005-mfd. condenser connected from 6V6 plate to cathode. Connect the replacement condenser to *screen* instead of cathode

FARNSWORTH AC-71, BC-72, AK-76

To improve short-wave performance of receivers using a 6H6 detector tube	1)	replace the 6H6 detector tube with a 6J5GT detector. Then realign the last i-f transformer. Locate terminal of the *No. 37* band switch which connects to one of the "external antenna" jumper posts. Install a jumper wire from this terminal of the *No. 37* switch to the loop shield. These changes will improve the short wave performance of the receiver
Fading (in AK-76 receiver)	1)	check 0.01-mfd. condenser connected from the arm of the volume control to grid of first audio 6SQ7

FARNSWORTH BK-77, BK-78

Circuit changes to make in early-run receivers for improved performance	1)	change 8,200-ohm resistor *No. 6* supplying the screens of the r-f converter and i-f tubes to 12,000-ohms
	2)	change 150,000-ohm resistor *No. 13* in the negative leg of the power supply circuit to 220,000-ohms. Ground it instead of connecting it to the mid-point of resistors *No. 8* and *No. 12*
	3)	change 10,000-ohm oscillator plate resistor *No. 5* to 22,000-ohms
	4)	change electrolytic condensers *No. 36* and *No. 37* from 350-volt and 250-volt rating units respectively, to 400-volt and 350-volt units respectively

FARNSWORTH BC-80, BC-81

Same Case History as that listed for Farnsworth AC-71 receiver

FARNSWORTH BKR-84

Howl or whistle in the records made	1)	ground one side of the voice coil circuit
	2)	keep cutting head connecting lead as short as possible and free from all other wires

FARNSWORTH BC-86, AC-90, AC-91, BC-92, AK-95, AK-96, BC-101, BC-102

Same Case History as that listed for Farnsworth AC-71 receiver

---

FEDERAL

FEDERAL RECEIVERS (using types 201-A, 222 and 226 tubes)

Type 'BA rectifier tube burned out, or requiring replacement	1)	replace with a type '5Z3 rectifier tube. Reconnect the high-voltage leads to the grid and plate terminals on the tube socket and provide a 5-volt filament voltage by a step-down transformer or possibly by winding an additional secondary on the power transformer core. The positive lead is taken from one of the filament terminals

---

FIRESTONE

FIRESTONE 1322 Auto Radio

Speaker rattle	1)	loose solder in speaker
Microphonics	1)	loosen rubber washers holding condensers
	2)	tighten all nuts and screws
"Metal-case buzz," Rattle		loosen "Parker-Kalon" screws, take cover off, bend, and replace

FIRESTONE (STEWART-WARNER) R-1431 (Chassis R-143) Auto Radio

Inoperative (vibrator may make loud mechanical hum) — 1) voltage readings across plate-cathode circuits of rectifier tube, but none across plates. Test for "shorted" 0.01-mfd. 1500-volt condenser across power transformer secondary (cond. is located on top of the transformer)

Inoperative when in upright position, O.K. when upside down — 1) inspect for burned braided lead in vibrator can. Replace

Ignition interference — 1) if a dash control is used, and ignition interference is experienced, connect a short "bond" from the end of the shielding which covers the pilot light lead to the control proper. Bond all cables and tubes which enter from the motor compartment, to "ground"

FIRESTONE R-3121 (Chassis R312)

Hum — 1) open filter condenser

Distortion — 1) open resistor in 25L6 grid circuit
2) leaky coupling condenser from 6Q7 plate to 25L6 grid

FIRESTONE S-7350-1 (Code PM7) Auto Radio

Inoperative or weak on manual tuning — 1) remove 1st and 2nd i-f transformer shields and inspect and check for shorted transf. May be caused by soldered leads cutting through insulating paper in the cam and shorting out the transformer

FIRESTONE S-7402-1

Improving sensitivity — 1) reset loop antenna at least ½ inch further away from chassis. Use bushings and longer mounting screws

FIRESTONE S-7402-6

Inoperative on batteries, O.K. when line-operated — 1) burned out pilot light, or loose connection in pilot light circuit

FIRESTONE S-7425-3

Intermittent reception — 1) one of the i-f coil terminal lugs intermittently "shorting" to back of speaker

FIRESTONE S-7427-8

Tuning eye action sluggish — 1) change 2-megohm resistor in *green* lead to tuning eye tube socket to a 500,000-ohm unit

---

FIRST NATIONAL

FIRST NATIONAL 10, 20, 20-B

Whistling or squealing —
1) check all r-f by-pass condensers
2) check volume control
3) check detector output filter
4) reduce the screen voltages by connecting the volume control to the extra tap provided on the voltage divider
5) shorten all control-grid leads as much as posisble to prevent interaction
6) try increasing the resistance values of the r-f bias resistors if necessary

(Cont'd)

FIRST NATIONAL 10, 20, 20-B—*(Cont'd)*

Hum — 1) if all parts and tubes check O.K., remove the lead between the first filter condenser and the high-potential end of the voltage divider. Connect it to the junction of the choke and the speaker field. By-pass the voltage divider with a 1-mfd. 300-volt condenser

---

FORD

(For routine auto-radio Installation and Ignition Inferer-ence Suppression Data pertaining to all models of Ford cars see *Section 10* of this *Handbook*. For Methods of Eliminating Persistent Ignition System Interference in various models of Ford cars, see *Section 11* of this *Handbook*)

FORD-MAJESTIC Auto Radios

Inoperative, Heavy "A"-battery drain, Fuses blow, (in types using separator vibrator) —
1) "leaky" or "shorted" 0.01-mfd. 1,000-volt vibrator condenser (at side of transformer) connected across the power transformer secondary. Replace with a 0.01-mfd. 1,600-volt condenser. Insulate the case with tape. Can containing transformer, rectifier tube and vibrator unit easily removed by unscrewing nut and lock-washer holding down unit and lifting it out
Before replacing, check contacts for burned wires. Excessive current often melts the solder and burns the two vibrator wires
File the points, resolder and remount
2) if the filter has blown, replace with a dual 4, 4-6 or 4-8 dual unit as the capacity value is not critical
3) defective type '6Y5 rectifier tube. Replace with type '84 tube, changing socket to five-pin type and discarding wire connected to spray shield
4) if screen voltage is absent, remove speaker and plate cover to right of speaker and then replace the *brown* resistor

Intermittent reception while riding, (performs O.K. on bench) — 1) intermittent short-circuiting of tube caps to shields. Insulate the tops by means of paper or cardboard discs

Excessive noise — 1) connect a 0.25- or 0.5-mfd. low voltage paper condenser across rectifier filament
2) check vibrator, or replace

Persistent motor noise even when antenna is disconnected from receiver — 1) interference getting through louvres in back of receiver case. Cut a piece of copper screen same size as back of chassis, and fasten to case over louvres with self-tapping screws holding the case together

Control-cable breaks repeatedly — 1) fish a No. 10 spring-steel piano wire through from the control-head end of the sleeve. This replaces the original stranded cable which frays and breaks

FORD-MAJESTIC 40 ("Glove Box") Auto Radio

Inoperative — 1) fuse clips (on both fuses in "hot" lead) work loose

Unstable operation —
1) bond tuning condenser gang and vibrator-unit shield more perfectly to rest of chassis
2) drill ventilation holes in case under vibrator to prevent excessive heating. This will lengthen life of condensers located there

FORD-MAJESTIC 118 Auto Radio

Fuse blows (heater circuit)	1)	lug on the pilot-light socket "grounded"
Reception cuts off (especially at low-frequency end of dial)	1)	replace the '6A7 tube—some have a tendency to stop oscillating at the lower frequencies
Double-hump tuning, Distortion	1)	30,000-ohm filter resistor in AVC circuit in the grid-return of the '6E7 r-f tube "grounded". Bend its leads so it clears the chassis

FORD-PHILCO N 1934 Auto Radio

Inoperative, (tubes and voltages test O.K.)	1)	padding condenser soldering lugs on tuning condenser frame puncturing through insulating paper glued to can of fixed condenser beneath, thereby grounding out the i-f. Bend the lugs up and slip a heavy piece of insulating fibre under them

FORD-PHILCO 3 Auto Radio

Weak at high-frequency end	1)	replace the 8,000-ohm cathode resistor in the '38 autodyne circuit with a new resistor of 6,000 ohms

FORD-PHILCO 1935 Auto Radio

Intermittent reception, Low volume	1)	header speaker cone leads short-circuiting to steel spring support
Intermittent reception (tubes O.K.)	1)	tap and wiggle the 0.01-mfd. condenser connected to volume control. If faulty, replace
Dial jumps calibration	1)	remove gears from dial assembly. Carefully "peen" out teeth of gear which holds pointer until it meshes closely with intermediate driving gear

FORD-PHILCO 1936 Auto Radio

Intermittent reception (tubes check O.K.)	1)	tap and wiggle the 0.01-mfd. condenser connected to volume control. If faulty, replace
	2)	check for poorly soldered connection at one of oscillator coil lugs
Hum (loud and deep)	1)	check all filter condensers
	2)	if filter condensers check O.K., check the 0.25-mfd. condenser in the grid return of output tube for "open" condition
Volume decreases when volume control is turned "on" full, Distortion	1)	secondary winding of second i-f transformer "open"

FORD-PHILCO 1937 Auto Radio

Ignition interference	1)	the shield of the lead-in is soldered to a lug riveted to the can of the coupling transformer (located behind the header board). This riveted connection is often unsatisfactory. Solder the shield directly to the can
	2)	male end of antenna lead making poor contact in receiver socket. Solder short, heavy braid to shield on male cap and fasten securely under edge of junction box after scraping off the paint
	3)	if some noise still persists, bond the middle screw on receiver cover to dash, also bond junction box to emergency brake bracket screw

(Cont'd)

FORD-PHILCO 1937 Auto Radio—*(Cont'd)*

	4)	if noise still persists, connect another by-pass condenser to the ignition switch—grounding it to the radio receiver case. Leave the original ignition-switch condenser in place also

FORD-PHILCO 1939 Auto Radio

Whistling or squealing at low-frequency end of dial	1)	shield the grid lead that passes in front of the tuning condenser from the untuned transformer to the grid of the detector-oscillator tube

FORD-PHILCO 6M-F490 (1940) Auto Radio

Noisy reception	1)	if all tubes and voltages check O.K., check loktal sockets and tube prongs for loose contacts, and for poor contact due to oxidization of metal contact surfaces

FORD-PHILCO T6-FT6 Auto Radio

Volume drops to low value intermittently	1)	check for faulty buffer condenser across rectifier plates. Replace
Weak reception	1)	check avc action of receiver
	2)	locate the 190,000-ohm resistor connected between second detector cathode and 25,000-ohm resistor in grid-return of second i-f transformer. Replace it with a 1-megohm resistor
	3)	remove the 25,000-ohm "bleeder" resistor located below tuning condenser under chassis

FORD-PHILCO T9-FT9 Auto Radio

Loud "squawks" when driving over rough roads	1)	first check vibrator
	2)	check the condenser with a good condenser checker. Usually one of the 0.25-mfd. condensers (one of the part *No. 30-4374* unit) causes trouble. In this case replace the entire block

FORD-PHILCO F-1440 Auto Radio

Inoperative, Intermittent reception	1)	check resistors *No.s 10 and 15* (refer to schematic diagram for this receiver. Due to the position of these resistors at the 78 tube socket, a "short" or "intermittent short" often occurs at one end of their wiring leads. It is well also to remove one lead from resistor *No. 15*, cover it with spaghetti, and resolder
	2)	check volume control for high-resistance leakage to ground

FORD-PHILCO F-1442 Auto Radio

Intermittent reception	1)	replace condenser in volume control input circuit

FORD-PHILCO F-1640 Auto Radio

Station indicator in tuning head gets out of synchronism with switch in receiver	1)	check and tighten all receiver "A" circuit connections which connect to the car wiring (Resistance in the "A" circuit of the receiver will reduce the receiver current without appreciably affecting the current to the solenoid in the head, thrus throwing them out of step with each other)
	2)	check 700-ohm ½-watt 7A7 i-f cathode resistor
Distortion	1)	"faulty," or "open," volume control which opens up 75 grid circuit
	2)	speaker cone needs realigning with shims

FORD-PHILCO F-1740 (1940) Auto Radio

Inoperative, Intermittent reception, Noisy	1)	"open" 3,300-ohm ½-watt resistor in r-f and detector plate supply. Replace with 1-watt unit. This condition usually caused by i-f transformer wiring grounding to can. Check primary windings for "open." If O.K., slip insulating tubing over leads
	2)	check 700-ohm ½-watt 7A7 i-f cathode resistor
Intermittently inoperative only at high-frequency end	1)	replace 25-mmfd. condenser in oscillator grid circuit
	2)	try new oscillator tube if necessary
Inoperative on all push-button positions	1)	faulty 300-mmfd. condenser between low end of oscillator coils and chassis
Intermittent hum and distortion	1)	if accompanied by high current drain, check for "gassy" 7C6 tube
Hum	1)	"open" filter condenser

FORDSON

FORDSON F, FX, X, 46, 52

Inoperative	1)	antenna coil burned out. Connect a 0.001- to 0.1-mfd. 400-volt condenser (determine best capacity to use by trial) in series with the antenna lead. Realign the receiver
	2)	check the antenna for possible "grounds"

FREED-EISEMANN
(Freed Mfg. Co., Inc.)

FREED-EISEMANN MB-9

Fading	1)	vibration or tapping causes the 0.02-mfd. coupling condenser between the '55 and '56 tubes to "short". Replace it

FREED EISEMANN FE-15, FE-18

"B" batteries short-lived	1)	heavy B-current drain caused by "leaky" 0.1-mfd. by-pass condenser in "B" circuit

FREED-EISEMANN NR-55, NR-56

Inoperative	1)	faulty 4,700-ohm large *yellow* carbon resistor. Any 5,000-ohm 5-watt resistor may be used as a replacement

FREED-EISEMANN NR-60

Noisy reception	1)	corroded variometer tap switch
	2)	loose carbon element of volume control

FREED-EISEMANN NR-65, NR-78, NR-79

Inoperative	1)	faulty 4,700-ohm large *yellow* carbon resistor. Any 5,000-ohm 5-watt resistor may be used as a replacement
Intermittent reception, Fading	1)	corroded connection beneath rubber insulation at terminal of 500-ohm, 1-watt fixed bias resistor connected in series with the volume control, causing the resistance to vary from 500- to 25,000-ohms when the chassis heats up. Replace with new unit
Hum	1)	open-circuited type '27 tube heater center-tap-to-ground lead. Resolder the connection

FREED-EISEMANN NR-80

Fading, Noise	1)	faulty volume control—replace it
	2)	defective tubes—check all tubes
	3)	poorly-soldered joints. Go over all joints with hot soldering iron
No control of volume	1)	volume control contact arm not engaging resistor strip
Hum, Distortion	1)	hum controls shorting to chassis

Also same case histories as listed for Freed Eisemann NR-85

FREED-EISEMANN NR-85

Noisy volume control	1)	connect a 2,000- or 3,000-ohm potentiometer across the antenna choke, enclosing the leads in grounded shielding
	2)	adjust the third neutralizing condenser to a point at about 150 kc, just below oscillation

FREED-EISEMANN 90

Same Case History as that listed for Freed-Eisemann MB-9 receiver

FREED-EISEMANN NR-95

Low volume	1)	defective dynamic speaker field supply filter condenser or rectifier tube

JESSE FRENCH

JESSE FRENCH Model G

Weak reception	1)	check the 1.0-megohm resistor in the detector screen grid lead. Replace. (This resistor frequently goes bad and a voltage analysis may not indicate trouble

FRESHMAN

FRESHMAN EQUAPHASE with G60S Power Pack

Whistling, Broad tuning	1)	equalizing condensers incorrectly adjusted
Inoperative	1)	trimmer condenser stator plate or lug shorting to chassis
	2)	hum control contact arm not making contact to resistance
Inoperative (no plate voltage), Distortion (no bias on 71A tube), Weak reception	1)	"open" resistors in power pack
Noisy reception	1)	open-circuited 300-ohm equaphase resistor
Fading	1)	defective volume control
Critical volume control, Fluctuating volume	1)	connect a jumper from the filament end of the control to the arm, or "ground" to chassis

FRESHMAN G

Volume control detunes receiver when adjusted, Selectivity poor	1)	disconnect the volume control lead from the antenna coil. Conenct a 0.1-mfd. by-pass condenser from the plate terminal of the second r-f coil to the "ungrounded" terminal of volume control
	2)	loosen the adjustments of the Equaphase condensers and set for maximum regeneration without instability
	3)	align the tuned stages
	4)	if necessary connect a 0.1-mfd. by-pass condenser from each filament terminal of the r-f socket to ground

FRESHMAN N

Inoperative	1)	loose terminals on power pack connection strip
Fading, No control of volume	1)	loose terminals on power pack connection strip
	2)	replace volume control
No reception, (low voltage)	1)	shorted r-f by-pass condenser
Weak or no reception	1)	defective pigtail resistors
No reception	1)	open-circuited output transformer

FRESHMAN 2N

Fading	1)	loose or corroded connections at connecting terminals in the power pack, making intermittent contact. Go over these terminals and tighten each with a large screwdriver
	2)	open-circuited filament winding in power transformer. Re-connect the leads from this winding to any of the other windings of the same voltage. If the r-f and audio tubes are heated from the same winding, replace the 1800-ohm r-f bias resistor with a 500-ohm unit, since there is now more current flowing in this circuit

FRESHMAN "PRESIDENT"

Hum, No grid voltage	1)	burned out resistor due to an internally-shorted tube. Check all tubes — then check resistors
	2)	centertapped resistor connected across the 1.5-volt filament winding "shorting" to chassis
Noisy or intermittent operation when tuning	1)	broken lead on the tickler coil. This coil is mounted on a cam which moves with the tuning condensers. Replace the broken lead with one which is more flexible

FRESHMAN Q-15, 3Q-15, Q-16, 3Q-16, QD-16-S

Intermittent reception, Fading	1)	defective type '22 tube biasing resistor. Replace with new unit
	2)	go over all socket connections, contacts and soldered joints for intermittent contacts
	3)	check all flexible pigtail resistors for fraying and breaks
Noisy reception, Intermittent reception	1)	open-circuiting flexible pig-tail resistors
Hum at resonance	1)	poor type '22 tube
	2)	check 0.25-mfd. filament by-pass condenser for "open"
Broad tuning, Whistling or squealing	1)	incorrect adjustment of regeneration control connected from det. plate to antenna

GABLE

GABLE 1937 Receivers

Inoperative (strong blue glow in 83 tube)	1)	check the wire on low side of filter choke. Insulation breaks down causing "short" to ground. Insulate it with spaghetti

GALVIN

See receivers listed under "Motorola"

GAMBLE-SKOGMO

See receivers listed under "Coronado"

GEM

GEM A.C.-D.C.

Inoperative	1)	defective speaker coil, usually open-circuited. Since the speaker here cannot be repaired, the unit should be replaced
Loud crackling noise after being in operation about an hour	1)	poor connection at the lug of the filter choke

GENERAL ELECTRIC *(AMERICAN)**† RECEIVERS

G. E. "COLOR TUNING"

Green lights are on constantly	1)	check for faulty rectifier
Green lights "out"	1)	since the three *green* bulbs are wired in series, one faulty bulb will cause all three to go "out"
Bulb replacement	1)	be sure the new bulb is of the same current rating as that of the one being replaced

GENERAL ELECTRIC "RADIO-FORTE"

Tuning motor operation slow and sluggish	1)	check for "leaky" or "lowered-capacity" 60-mfd. electrolytic condenser across tuning motor winding

GENERAL ELECTRIC 1937 Models

Colorama pilot lights burn out	1)	insert a 150-ohm resistor in the center-tap lead of the high-voltage winding. Also connect a 15-ohm resistor in series with the Colorama bulbs
	2)	if green lights are on constantly, check the rectifier for trouble

GENERAL ELECTRIC 1937 Auto Radios

Distortion (intermittently at low volume)	1)	inspect power tube socket for poor prong contacts due to melted wax from r-f 1-mfd. by-pass condenser. Clean
Erratic operation	1)	check for faulty discriminator transformer winding

GENERAL ELECTRIC 1938 Battery Receivers

Distortion (tubes, voltages check O.K.)	1)	replace grid bias cell in first audio stage

* For Case Histories of *Canadian* General Electric Receivers, see the listings in the "General Electric (*Canadian*)" group. This follows immediately after the General Electric (*American*) receivers.

† For a cross-index of the Model numbers of *American* G. E. with those of corresponding *American* RCA and RCA-Victor, Westinghouse, and Graybar receivers, see the list in *Section 5* of this book.

GENERAL ELECTRIC BX

(Uses same chassis as RCA R-17M receiver.) See also the Case Histories listed for the RCA R-17M receiver

Inoperative accompanied by hum, Whistling or squealing with signals in background	1)	check for "open" or decreased capacity tubular electrolytic condensers

GENERAL ELECTRIC H

Carrier hum	1)	check for "broken" wire on shield cage

GENERAL ELECTRIC B-1

(Uses same chassis as RCA Radiola 21 receiver.) See the Case Histories listed for RCA Radiola 21 receiver

GENERAL ELECTRIC B-2

(Uses same chassis as RCA Radiola 22 receiver.) See the Case Histories listed for RCA Radiola 22 receiver

GENERAL ELECTRIC M-S

Fading	1)	"opening" of 0.01-mfd. 600-volt coupling condenser connected from plate of 6B7 to grid of 42 tube. Replace

GENERAL ELECTRIC T-12

(Uses same chassis as RCA R-5 receiver.) See the Case Histories listed for the RCA R-5 receiver

GENERAL ELECTRIC C-14 Auto Radio

Inoperative with auto antenna, Volume control inoperative	1)	open-circuited 0.02-mfd. condenser (*C16*) connected from the diode section of the type '6B7 tube through the variable arm of the volume control to the control grid of the triode section of the same tube. Replace with new unit

GENERAL ELECTRIC 18

Hum	1)	faulty antenna condenser

GENERAL ELECTRIC S-22

(Uses same chassis as RCA R-7 "Superette" receiver.) See the Case Histories listed for the RCA R-7 "Superette" receiver

GENERAL ELECTRIC S-22, S-22-X

(Uses same chassis as RCA R-7 receiver.) See the Case Histories listed for the RCA R-7 receiver

GENERAL ELECTRIC S-22 Duo

(Uses same chassis as RCA R-7A receiver.) See the Case Histories listed for the RCA R-7A receiver

GENERAL ELECTRIC H-31

(Uses same chassis as RCA Radiola-80 receiver.) See also the Case Histories listed for the RCA Radiola-80 receiver

Intermittent reception	1)	check primary windings of i-f transformers
Distortion at low-volume setting	1)	check for drop in value of 110,000-ohm unit on voltage-divider resistor strip

GENERAL ELECTRIC H-32

(Uses same chassis as RCA Radiola-50 receiver.) See also the Case Histories listed for the RCA Radiola-50 receiver

Fading (reception can be restored by removing avc tube)	1)	check for "leaky" by-pass condensers in avc circuit. Replace condensers *C-32*, *C-34* and *C-35*
Intermittent reception	1)	14,000-ohm screen grid voltage-dropping resistor reduced in value. Replace
Whistling or squealing	1)	check for "open" 0.1-mfd. screen by-pass condenser

GENERAL ELECTRIC LRP-32 Automatic Record Changer

Mechanism trips too early	1)	friction trip adjustment too tight
	2)	too little overlap between trip lever and starting lever. Bend spring on end of trip lever
Mechanism fails to trip	1)	friction trip adjustment too loose
	2)	oil on friction washer
	3)	too much overlap between trip lever and starting lever. Bend spring on end of starting lever
Mechanism continues to cycle	1)	end of starting lever may not be rising above starting pin. Starting lever, or trip lever, may be bent
Irregular landing on 10- and 12-inch records	1)	check feed-in spring. May be bent or out of adjustment
	2)	check to see if feed-in spring has gotten on wrong side of the crank arm pin—in which case there will be no feed-in action at all
Mechanism jams	1)	end of starting lever bent
	2)	gears are out of time
	3)	end of starting lever bent as it rises too high and catches on the pinion gear extension. Bent trip lever may also cause this trouble
	4)	mechanism slows down due to excessive friction or rubbing somewhere
Mechanism fails to eject records	1)	vertical rocker arm bent, or binding where it comes through motorboard
	2)	ejector pin needs adjustment
	3)	chipped or warped records
"Wow"	1)	bent record spindle
	2)	flat spot on motor drive wheel

GENERAL ELECTRIC 40 (Auto Radio)

Noisy after standard "suppression" preventors have been installed	1)	"ground" the rubber-mounted triangular plate of the tuning control sheath to the side of the chassis with a short piece of "bonding" braid

GENERAL ELECTRIC B-40 Auto Radio

(Uses same chassis as RCA M-34 Auto Radio receiver.) See the Case Histories listed for RCA M-34 receiver

GENERAL ELECTRIC K-40

(Uses same chassis as RCA R-27 receiver.) See the Case Histories listed for the RCA R-27 receiver

GENERAL ELECTRIC K-40A

Weak reception, Distortion	1)	high leakage or total short-circuiting of double 4-mfd. electrolytic condensers. The most troublesome unit is in the '25Z5 circuit and the next is in the type '77 or type '78 cathode circuits
	2)	defective type '25Z5 tube, (even though it tests O.K.). Replace with new tube

(Cont'd over)

GENERAL ELECTRIC K-40A—*(Cont'd)*

Weak reception, Distortion *(Cont'd.)*
3) inspect antenna wire at the loop on top of the tuning condenser. If this is accidentally "grounded", one terminal of the '25Z5 tube is very likely to be burned off. In this case, be sure that the trouble has been remedied before replacing the rectifier
4) worn insulation on antenna lead where it passes through chassis

Fading
1) faulty 0.01-mfd. coupling condenser between the detector plate and the grid of the output tube

GENERAL ELECTRIC M-40

(Uses same chassis as RCA-102 receiver.) See the Case Histories listed for the RCA-102 receiver

GENERAL ELECTRIC BX-41

(Uses same chassis as RCA R-17-M receiver.) See the Case Histories listed for RCA R-17-M receiver

GENERAL ELECTRIC C-41 Auto Radio

Regeneration in a-f circuit, (intense shrillness present when set is operated at half volume)
1) reverse input or output leads in interstage transformer, thereby changing the phase of the transformer and preventing coupling with some other part in the receiver

GENERAL ELECTRIC K-41

(Uses same chassis as R-17-M receiver.) See the Case Histories listed for the RCA R-17-M receiver

GENERAL ELECTRIC T-41

(Uses same chassis as RCA Radiola 48.) See the Case Histories listed for RCA Radiola 48 receiver

GENERAL ELECTRIC M-42

Motorboating sound on last ¼ position of volume control —then reception cuts off
1) realign receiver tuned circuits carefully

GENERAL ELECTRIC S-42

(Uses same chassis as RCA R-9 receiver.) See the Case Histories listed for the RCA R-9 receiver

GENERAL ELECTRIC S-42-B

(Uses same chassis as RCA R-43 receiver.) See the Case Histories listed for the RCA R-43 receiver

GENERAL ELECTRIC SZ-42-P

(Uses same chassis as RCA RE-16 receiver.) See the Case Histories listed for the RCA RE-16 receiver

GENERAL ELECTRIC K-43

(Uses same chassis as RCA-100 receiver.) See the Case Histories listed for the RCA-100 receiver

GENERAL ELECTRIC M-49 (Phonograph Motor)

Starting difficulty
1) failure of stator to rotate on the outer bearing, due to spaghetti sleeve sticking in the slot or to the resilient bumper
2) improper lubrication on outer bearing

(Cont'd)

GENERAL ELECTRIC M-49 (Phonograph Motor)—*(Cont'd)*

Noisy motor
1) many noisy M-49 synchronous reactor motors may be easily quieted in the following way: Make a centering jig from a stator assembly (part *No. 7653*) and a bushing (contained in part *No. 7657*). Place the turntable on the bench face down, slip the bushing over the shaft and then slip the stator over the bushing. Spacers for centering the rotor can be quickly made from some pieces of celluloid. Loosen the screws holding the rotor to the turntable, place several spacers around the circumference of the stator in the air gap between the stator teeth and the rotor teeth. Turn the stator slowly while tightening the turntable screws, and this should center the turntable. Use care while doing this

GENERAL ELECTRIC D-50 Auto Radio

(Uses same chassis as RCA M-101 receiver.) See the Case Histories listed for the RCA M-101 receiver

GENERAL ELECTRIC E-50, E-52

Audio whistle, Distortion (on high volume)
1) one or both sections of 8.8 mfd. dual filter condenser low in capacity. Replace

GENERAL ELECTRIC K-50

(Uses same chassis as RCA R-28 receiver.) See the Case Histories listed for the RCA R-28 receiver

GENERAL ELECTRIC K-50-P

(Uses same chassis as RCA R-28-P receiver.) See the Case Histories listed for the RCA R-28-P receiver

GENERAL ELECTRIC L-50

(Uses same chassis as RCA R-22-S receiver.) See the Case Histories listed for the RCA R-22-S receiver

GENERAL ELECTRIC M-50

(Uses same chassis as RCA-117 receiver.) See the Case Histories listed for the RCA-117 receiver

GENERAL ELECTRIC D-51 Auto Radios

(Use same chassis as RCA M-104 receiver.) See the Case Histories listed for the RCA M-104 receiver

GENERAL ELECTRIC E-51

Inoperative
1) check for plate prong of output tube "shorting" to chassis

Loud hum peaked at around 1,200 kc on dial
1) the 0.01-mfd. condenser (*TC-26*) connected between the diode plate and B minus should be shunted by another 0.1-mfd. condenser

GENERAL ELECTRIC H-51

(Uses same chassis as RCA Radiola-82 receiver.) See the Case Histories listed for the RCA Radiola-82 receiver

GENERAL ELECTRIC K-51

Low volume
1) defective series padding condenser in the type '2A7 circuit. Replace
2) defective type '2A7 tube (even though it may test O.K.). Replace
3) oscill. and i-f circuits out of alignment

GENERAL ELECTRIC K-51-P

(Uses same chassis as RCA R-28-P (A to G) receiver.) See the Case Histories listed for the RCA R-28-P (A to G) receiver

GENERAL ELECTRIC M-51

(Uses same chassis as RCA-118 receiver.) See the Case Histories listed for the RCA-118 receiver

GENERAL ELECTRIC 51-R

Same Case Histories as those listed for Radiola 80

GENERAL ELECTRIC A-52

Microphonic howl (at 6 mgc.)	1)	short-wave trimmers do not have full tension and vibrate at this particular frequency—causing the set to "howl". Remove the trimmer screws to bend the trimmers so they have full tension. Put the screws back in place, and realign the short-wave band

GENERAL ELECTRIC B-52

Same Case Histories as those listed for RCA M-116 receiver

GENERAL ELECTRIC D-52 Auto Radio

Same Case Histories as those listed for RCA M-104 receiver

GENERAL ELECTRIC K-52

(Uses same chassis as RCA-110 receiver.) See the Case Histories listed for the RCA-110 receiver

GENERAL ELECTRIC M-52

(Uses same chassis as RCA-119 receiver.) See the Case Histories listed for the RCA-119 receiver

GENERAL ELECTRIC A-53

See also the Case History listed for G.E. A-52 receiver

Inoperative	1)	open or high-resistance contacts on band switch
Distortion, "Squawking" noise	1)	short-circuited condensers *C-16* or *C-26*. Replace with new units
Noisy reception, Hissing noise, "Birdies"	1)	defective type '6K7 r-f tube (even though it may test O.K.). Replace with new tube

GENERAL ELECTRIC K-53

(Uses same chassis as the RCA-111.) See the Case Histories listed for the RCA-111 receiver

GENERAL ELECTRIC K-53-M

(Uses same chassis as RCA-115 receiver.) See the Case Histories listed for the RCA-115 receiver

GENERAL ELECTRIC A-54

Whistling, Distortion (at low-frequency end of broadcast band with tone control at high-frequency setting *only*)	1)	open-circuit or high-resistance connection at condenser *C27*. Resolder connections to this condenser and note the effect

GENERAL ELECTRIC K-54

(Uses same chassis as RCA RAE-40 receiver.) See the Case Histories listed for the RCA RE-40 receiver

GENERAL ELECTRIC K-54-P

(Uses same chassis as RCA RE-40-P receiver.) See the Case Histories listed for the RCA RE-40-P receiver

GENERAL ELECTRIC A-55

Same Case History as that listed for G. E. A-52 receiver

GENERAL ELECTRIC G-55

Distortion, Reception cutting off completely	1)	shorted 0.5-mfd. 100-volt '41 tube grid-bias by-pass condenser. Replace with unit of higher voltage rating

GENERAL ELECTRIC K-55

(Uses same chassis as RCA-210 receiver.) See the Case Histories listed for the RCA-210 receiver

GENERAL ELECTRIC M-55

(Uses same chassis as RCA-214 receiver.) See the Case Histories listed for the RCA-214 receiver

GENERAL ELECTRIC M-56

(Uses same chassis as RCA-211 receiver.) See the Case Histories listed for the RCA-211 receiver

GENERAL ELECTRIC 60 Series

Audio howling	1)	due to 6Y6G audio driver tube. Replace

GENERAL ELECTRIC C-60 Auto Radio

Noise-level high, Antenna trimmer has no effect	1)	if the receiver has leads brought out only to five lugs on the antenna coil (one unused), connect grid lead from variable condenser to vacant lug instead of original connection, so that the full secondary winding is used

GENERAL ELECTRIC GD-60

Fading	1)	antenna pri. or sec. windings, or sec. winding of 2nd i-f coil, increasing resistance due to poorly soldered connections. Resolder
Noisy	1)	replace filter using 40-mfd. cond. from rectifier cathode to switch, and 16-mfd. from screen to cathode of 25L6G

GENERAL ELECTRIC K-60

(Uses same chassis as RCA R-37 receiver.) See the Case Histories listed for the RCA R-37 receiver

GENERAL ELECTRIC K-60-P

(Uses same chassis as RCA R-37-P receiver.) See the Case Histories listed for the RCA R-37-P receiver

GENERAL ELECTRIC N-60 (Auto Radio)

Ignition interference	1)	lengthen the distributor rotor arm by peening it
Inoperative (no voltages)	1)	faulty 6X5 tube
	2)	condenser block "shorted"
	3)	condenser across 6X5 plates "shorted"
Howling	1)	try a new 6Q7 tube
Noisy	1)	check for a microphonic tube

GENERAL ELECTRIC C-61 Auto Radio

Periodic whistling, Motorboating	1)	faulty type '6D6 tube
	2)	faulty type '41 tube
	3)	faulty 0.5-mfd. screen by-pass cond.

GENERAL ELECTRIC M-61

(Uses same chassis as RCA-128 receiver.) See the Case Histories listed for the RCA-128 receiver

GENERAL ELECTRIC K-62

(Uses same chassis as RCA R-11 receiver.) See the Case Histories listed for the RCA R-11 receiver

GENERAL ELECTRIC KZ-62-P

(Uses same chassis as RCA R-18 receiver.) See the Case Histories listed for the RCA R-18 receiver

GENERAL ELECTRIC M-62

(Uses same chassis as RCA-125 receiver.) See the Case Histories listed for the RCA-125 receiver

GENERAL ELECTRIC 63, 65

Intermittent reception on one band	1)	broken small ceramic bushing on band switch. These bushings, held in place by pressure, are easily replaced

GENERAL ELECTRIC A-63

Inoperative	1)	check for "shorted" 0.05-mfd. condenser by-passing 6A8 plate supply. Replace with 600-volt condenser. Also check 6,000-ohm resistor in this same circuit for possible damage
	2)	replace 0.02-mfd. condenser between 6F5 and 6F6 tubes
Inoperative on s.w. band, O.K. on broadcast	1)	"open" 3600-mmfd. oscillator condenser *C-9*. Replace
Inoperative, Weak reception	1)	"open" 2,000-ohm plate-dropping resistor
	2)	replace 0.05-mfd. by-pass cond. in grid circuit of 6K7 i-f tube
Inoperative with tone control in "bass" position	1)	if the 0.03-mfd. 400-v. tone-control condenser "shorts", replace it with a 1000-volt unit
Distortion with tone control in "treble" position	2)	check the 8,000-ohm 1-watt resistor in series with the condenser. Replace it if necessary
Intermittent reception (both broadcast and short-wave bands)	1)	inspect the lugs of the r-f and oscillator coils. See that they do not "short" to the mounting nuts on the transformers
High voltage between type '6A7 or '6A8 tube and ground	1)	open-circuit between shield pin of type '6K7 tube and socket resulting in an "open" ground contact. This causes the '6K7 to oscillate and draw grid current through *R-11*, resulting in the appearance of a d-c voltage across it and from the type '6K7 or '6A7 tube to the control-grid ground
Weak reception on all bands	1)	"open" 4-mfd. 450-volt condenser *C-26*. This is a section of the dry electrolytic condenser pack—the section connected to the *red* lead which connects between the chassis and oscillator coil primary winding B-plus lug
Noisy reception at high volume causing interference in other sets	1)	filings in air-gap of speaker
Noisy	1)	field coil breaking down to ground
High hum level	1)	filter the plate circuit of the 6F5 or 6C5 tubes by introducing an additional 50,000-ohm carbon resistor between the plate load resistor and the voltage supply. By-pass the junction point of the two resistors to "ground" with a good 0.1-mfd. condenser
	2)	if necessary, shield the control-grid wire of the '6F5 tube
Distortion	1)	"open", or "partially open" 250,000-ohm resistor (*R8*) in the plate circuit of the '6F5 tube

(Cont'd)

GENERAL ELECTRIC A-63—*(Cont'd)*

Distortion and low volume	1)	"shorted" or "leaky" 0.03-mfd. tone-control condenser
Howling	1)	blow out any dust particles that are lodged between the tuning condenser plates
	2)	see that the oscillator tube prongs all make good contact, and that the oscillator and i-f tube grid caps fit snugly
	3)	dress the short-wave oscillator primary lead against and along the r-f short-wave primary bus
	4)	move the r-f broadcast primary lead away from the oscillator short-wave primary lead
	5)	dress the *green* rubber-covered lead from the band switch to the r-f section of the gang against and around the front gang condenser retaining bolt
	6)	dress the *yellow* AVC return-lead (from the r-f secondary to the i-f secondary) so it does not touch either the twisted filament pair or the oscillator primary common (white, red tracer)

GENERAL ELECTRIC F-63

Inoperative, Intermittent operation	1)	check output transformer primary for "open." If receiver "squeals" when output transf. is replaced, reverse the primary leads
Inoperative (antenna coil burned out)	1)	faulty waveband switch which goes beyond "stop" position and places 98 volts on the winding
Fading intermittently	1)	bond front dial plate to tuning condenser frame
Distortion on strong signals	1)	resistor *R-3* (see schematic circuit diagram connected to wrong lug on terminal strip
Pointer does not move when dial knob is turned	1)	insufficient friction in dial-drive assembly. Insert small fibre or cardboard strips between pressure plates

GENERAL ELECTRIC K-63

(Uses same chassis as RCA-120 receiver.) See the Case Histories listed for the RCA-120 receiver

GENERAL ELECTRIC A-64

Severe a-c hum	1)	electrostatic shield of the cartridge-type electrolytic by-pass condenser (*C23*) touching the high a-c voltage terminal of the type '5Z4 rectifier tube socket. Move the condenser away from the terminal, and wind tape or insulating paper over the shield
Inoperative (no screen voltage)	1)	open 8,800-ohm section (*R-9*) in the voltage divider. A 9,000-ohm replacement may be used
Intermittent reception, Fluttering signal, Inoperative	1)	to determine whether this condition is caused by "open" or high-resistance contacts on the band switch, remove chassis from cabinet and set it so the band switch is accessible. Tune the set to a signal and probe the rotor contacts with a non-conductive rod. It may be found that the springs behind the contacts have lost their tension; this is easily remedied by bending the spring with a pair of long-nose pliers toward the stationary section of the switch

(Cont'd)

GENERAL ELECTRIC A-64—*(Cont'd)*

If the relationship of the contact arms is such that both front and rear arms do not make contact at the same time, the following procedure should be used:- Loosen clamp nut on front of chassis and twist front section of switch in either direction until both contact arms seat properly. This adjustment is limited due to the stopping lug, and if it is not sufficient to correct the difficulty, the flat shaft may be bent by using two pairs of pliers

All contacts should be cleaned carefully with abrasive paper and wiped off afterwards with cloth. At no time should lubricant of any kind be used on this switch. If the switch should work stiffly, the trouble will probably be found in the external mechanism of the switch assembly. Operating arms of the external mechanism should be examined for straightness, and all moving parts oiled

Better reception on local stations with the type '6H6 tube removed	1)	open-circuited secondary in the second i-f transformer
Distortion	1)	value of 500,000-ohm 6J7 audio tube plate-dropping resistor has increased. Replace it with a resistor that will bring the plate voltage on this tube up to about 800 volts

GENERAL ELECTRIC K-64

(Uses same chassis as RCA-121 receiver.) See the Case Histories listed for the RCA-121 receiver

GENERAL ELECTRIC A-65

Same Case Histories as those listed for General Electric A-63 receiver

GENERAL ELECTRIC F-65

See also Case Histories listed for General Electric F-63 receiver

Whistling or squealing (tone control inoperative)	1)	if all components check O.K., try replacing the output transformer

GENERAL ELECTRIC G-65

Whistling or squealing, Distortion	1)	move 0.012-mfd. condenser (connected from plate of 6K6G tube) further away from automatic tuning lead to reduce feedback

GENERAL ELECTRIC K-65

(Uses same chassis as RCA R-38 receiver.) See the Case Histories listed for the RCA R-38 receiver

GENERAL ELECTRIC K-65-P

(Uses same chassis as RCA R-38-P receiver.) See the Case Histories listed for the RCA R-38-P receiver

GENERAL ELECTRIC M-65

(Uses same chassis as RCA-221 receiver.) See the Case Histories listed for the RCA-221 receiver

GENERAL ELECTRIC A-66

Intermittent reception, Fluttering signal, Inoperative	1)	see Case History for this same trouble listed for General Electric A-64 receiver
Severe a-c hum	1)	electrostatic shield of the cartridge-type electrolytic by-pass condenser (*C-23*) touches the a-c high-voltage terminal of the '5Z4 rectifier tube socket. Move the condenser away from the terminal, and wind tape or insulating paper over the shield
Inoperative (only noise heard)	1) 2)	try new 6A8 oscillator tube check 0.05-mfd. condenser by-passing 40,000-ohm grid resistor

GENERAL ELECTRIC F-66

Same Case Histories as listed for General Electric F-63 receiver

GENERAL ELECTRIC K-66

(Uses same chassis as RCA-220 receiver.) See the Case Histories listed for the RCA-220 receiver

GENERAL ELECTRIC M-66

(Uses same chassis as RCA-226 receiver.) See the Case Histories listed for the RCA-226 receiver

GENERAL ELECTRIC A-67

See also Case Histories listed for General Electric A-64 receiver

Inoperative	1)	"shorted" condenser shunting the Cand-ohm resistor
Intermittent reception, Fluttering signal, Inoperative	1)	see Case History for this same trouble listed for General Electric A164 receiver
Noisy reception developing into distortion	1)	faulty 500,000-ohm grid resistor for '6F6 tube (even though it may test O.K. when set is turned off). Replace
Poor tone, Distortion	1)	install a 150,000-ohm output grid resistor in place of the original 500,000-ohm unit

GENERAL ELECTRIC C-67 Auto Radio

(Uses same chassis as RCA M-104 receiver.) See the Case Histories listed for the RCA-223 receiver

GENERAL ELECTRIC M-67

(Uses same chassis as RCA-224 receiver.) See the Case Histories listed for the RCA-224 receiver

GENERAL ELECTRIC M-68

(Uses same chassis as RCA-321 receiver.) See the Case Histories listed for the RCA-321 receiver

GENERAL ELECTRIC A-70, A-75

Weak	1)	this condition results when the second i-f plate by-pass condenser (*C-28*), either due to vibration or to an accidental pressure, is forced into contact with the plate lug of the second i-f transformer nearest the 6K7 i-f tube. This causes plate potential to be applied to the electrolytic shield of the condenser. Its effect is an approximate decrease in sensitivity of 30%. This may be partially compensated by unscrewing the plate coil trimmer screw as far as it will go. However, before attempting to align the i-f amplifier be sure that the condenser is entirely free from this lug. When this set is aligned at the factory, this condition does not exist and the mere removing of this condenser from actual contact will automatically return the i-f to perfect alignment
	2)	in the earlier models it will be noted that the diode plate lead (*green* rubber covered) is soldered to one of the lugs of the second i-f transformer. If for any reason it is necessary to remove or replace this transformer or wire, it is important that the wire be dressed as far as possible toward the *front* of the chassis to obtain full sensitivity. Sets carrying later serial numbers have this lead tied to the center tap of the coil inside the can. However, it is still necessary to keep it toward the front of the chassis to prevent a feedback between the plate dropping resistor (between the first and second i-f transformers) and the lead itself
Rattling (sounding like "speaker rattle")	1)	a loose part in the receiver, dial or cabinet. The trouble is often caused by the celluloid dial strip which vibrates loose
Howling (on "D" band between 10 and 18 mgc.)	1)	inspect the oscillator coil of the "B-D" bands, and if there is a resistor mounted directly on the coil across the tickler of the "D" coil, clip it off carefully. Remove 100-mmfd. condenser *C44*, and substitute a 50-mmfd. micamold condenser for it. This will reduce the coupling of the oscillator, with a negligible loss of sensitivity. Now check the alignment of the "D" band, and realign if necessary

GENERAL ELECTRIC J-70

(Uses same chassis as RCA R-4 receiver.) See the Case Histories listed for the RCA R-4 receiver

GENERAL ELECTRIC E-71

Inoperative	1)	check 0.02-mfd. second i-f plate by-pass condenser for a "short"
	2)	check 2,200-ohm plate dropping resistor by removing second i-f coil shield
Intermittent reception	1)	faulty condenser connected to volume control
Weak reception	1)	replace 2,200-ohm second i-f cathode resistor
Power transformer overheats, smokes	1)	check for "shorted" condenser in 6K7 i-f tube plate return filter

GENERAL ELECTRIC H-71

(Uses same chassis as RCA Radiola-86 receiver.) See the Case Histories listed for the RCA Radiola-86 receiver

GENERAL ELECTRIC D-72 Auto Radio

(Uses same chassis as RCA M-109 receiver.) See the Case Histories listed for the RCA M-109 receiver

GENERAL ELECTRIC E-72

Inoperative	1)	"shorted" 0.02-mfd. condenser connected to primary of i-f coil in can next to dial. Also check for damaged 25,000-ohm resistor located inside this coil can

GENERAL ELECTRIC H-72

(Uses same chassis as RCA RAE-59 receiver.) See the Case Histories listed for the RCA RAE-59 receiver

GENERAL ELECTRIC J-72

See also the Case Histories listed for the RCA R-70 receiver

Motorboating sound, Poor sensitivity, Whistling or squealing	1)	replace entire filter block even though only one or two condensers in it may be "faulty"

GENERAL ELECTRIC F-74

Motorboating sound at low-frequency (intermittently)	1)	tighten all i-f cans for better contact

GENERAL ELECTRIC 75

Fading	1)	faulty volume control

GENERAL ELECTRIC A-75

Inoperative, Weak reception	1)	check for "shorted" 0.1-mfd. 400-volt i-f plate by-pass condenser *C-37*. Replace with 600-volt unit. Also check for overheated 1,000-ohm 6K7 plate resistor *R-9*. Replace with ½-watt unit
Fading out after playing O.K. for short time	1)	check 0.1-mfd. condenser in avc lead of i-f amplifier

GENERAL ELECTRIC F-75

Noisy when receiver is moved or jarred	1)	louvre dial not properly grounded. Check contact of copper ribbons at points where they are spot welded to chassis

GENERAL ELECTRIC J-75

(Uses same chassis as RCA R-6 receiver.) See the Case Histories listed for the RCA R-6 receiver

GENERAL ELECTRIC E-76

Inoperative on broadcast band	1)	"shorted" 0.01-mfd. 200-volt condenser connected to shaft of all-wave switch by *green* wire. Place with 600-volt unit

GENERAL ELECTRIC G-76

Inoperative, Intermittent reception	1)	output transformer case has sharp edge that cuts through and cuts the leads. Remove transformer and file down sharp edge. Insulate the leads

GENERAL ELECTRIC 78

Inoperative	1)	lack of plate voltage on the '56 driver tubes, caused by a faulty 1,100-ohm bias resistor connected from the cathodes of these tubes to the chassis

GENERAL ELECTRIC K-78

See also Case Histories listed for RCA 330 receiver

Whistling or squealing when volume control is near maximum setting	1)	check for "open" 4-mfd. section of 10-4 mfd. electrolytic block located under power transformer

GENERAL ELECTRIC R-78

(Uses same chassis as the RCA-330 receiver.) See the Case Histories listed for the RCA-330 receiver

GENERAL ELECTRIC J-79

Whistling, Broad tuning, Noise when tuning	1)	poor electrical connection between tuning condenser rotors and chassis. Clean and bend contact springs — or better still, install pigtail connections

GENERAL ELECTRIC K-79

(Uses same chassis as RCA-331 receiver.) See also the Case Histories listed for the RCA-331 receiver

Whistling or squealing when volume control is near maximum setting	1)	check for "open" 4-mfd. section of 10-4 mfd. electrolytic block located under power transformer

GENERAL ELECTRIC 80 Series

Fading	1)	faulty AVC tube
Audio howl	1)	replace 6Y6G driver tube. Try several replacements until a quiet tube is found

GENERAL ELECTRIC J-80

(Uses same chassis as RCA R-8 receiver.) See the Case Histories listed for the RCA R-8 receiver

GENERAL ELECTRIC K-80, K-80-X

(Use same chassis as RCA-141 and RCA 141-E receivers.) See the Case Histories listed for the RCA-141 and RCA 141-E receivers

GENERAL ELECTRIC E-81

5Z4 tube goes bad frequently	1)	check filament voltage on the 5Z4 tube. If it is much over 5 volts, connect a 10-watt resistor of low resistance value in series with the filament in order to reduce filament voltage to normal value
Inoperative (E-86 receiver)	1)	"open" screen-grid section of voltage divider
Noisy between stations (E-81 and E-86 receivers)	1)	remove the 2,200-ohm cathode resistor of the 6K7 first i-f tube. This resistor is under the chassis. Substitute a 25,000-ohm resistor in its place. Remove the r-f cathode wire running to "ground", on the 6K7 r-f tube socket and connect it to this 10,000-ohm resistor. This will retard the AVC action
High noise level (E-91, E-95, E-101, E-105 receivers)	1)	break cathode connection of the 6K7 first i-f tube and bias it through a 10,000-ohm ½-watt resistor. By-pass with a 0.05-mfd. condenser

(Cont'd)

GENERAL ELECTRIC E-81—*(Cont'd)*

Intermittent reception and "clicking" noise (E-105 receiver)	1)	faulty 6L6 power output tube (not usually indicated by tube tester). Replace tube
Weak reception, and green focussing lights do not change when set is tuned (E-105 receiver)	1) 2)	faulty 5Z4 rectifier tube. Replace check carefully for a defective focussing light bulb, for they are wired in series
Distortion, low volume after 10 minutes of operation (E-81 receiver)	1)	if plate voltage of the 6L6 tube drops to about 25 volts check to see if the 6L6 is "shorted" internally to shield. Replace with either a 6L6 or 6L6G tube
Noisy volume control (E-86, E-95, E-105 receivers)	1)	before replacing volume control, try replacing 6F5 first a-f tube

GENERAL ELECTRIC M-81

(Uses same chassis as RCA-143 receiver.) See the Case Histories listed for the RCA-143 receiver

GENERAL ELECTRIC A-82

See also Case Histories listed for General Electric A-86 receiver

Inoperative	1)	"shorted" 6A8 screen by-pass condenser
Inoperative (with tone control in extreme "bass" position)	1)	"shorted" or "leaky" 0.08-mfd. tone-control condenser. Reception may be obtained with volume control in "treble" position, but volume control will be exceedingly noisy
Sensitivity control inoperative	1)	check position of the '6A8 bias resistor within the "sentry box". The lead of this carbon resistor (soldered to a lug on the terminal strip) often "grounds" to the case of the long-wave band padding condenser
Weak	1)	fixed padder condenser (*C-46*) across secondary of the second i-f transformer should be 65-mmfd. In some cases, this condenser changes value enough to throw the second i-f out of alignment. The trimmer (*C-45*) will not peak, and the reception will be weak. Replace *C-46* by another 65-mmfd. condenser
Fading	1)	"flash" either of the i-f primary trimmers to chassis with a screwdriver. Trouble is due to internal "shorting" and leakage of the air-tuned i-f trimmer condensers ("Permaliners") employed. Replace these trimmer condensers if necessary
Howling	1) 2) 3) 4)	place washers under feet of chassis so it does not touch cabinet oscillator section of gang condenser vibrates. Place fibre washers between the rubber mounting of the condensers so as to change the vibration period of the gang if shield can on oscillator section of sentry box vibrates, line the inside with "adhesive" or "masking" tape to dampen the vibration and consequent howl try removing the rubber grommets in the escutcheon and tuning controls. If the howl disappears, the escutcheon brass should be realigned

(Cont'd over)

GENERAL ELECTRIC A-82—*(Cont'd)*

Rumbling noises, Whistling, (low volume)	1)	resolder all connecting leads to both the primary and secondary windings of the second i-f transformer
Noisy over broadcast band and intermittent reception on short-wave bands	1)	"open" r-f plate circuit by-pass condenser "Sentry-box" assembly must be removed in order to reach it. Replace with new 0.25 to 0.5-mfd. condenser to clearup noise

GENERAL ELECTRIC J-82

(Uses same chassis as RCA-71 receiver.) See also the Case Histories listed for the RCA R-71 receiver

Weak reception, Whistling, Motorboating sound	1)	replace *entire* filter block (do not replace only any individual sections that may test "faulty")

GENERAL ELECTRIC J-83

(Uses same chassis as RCA R-73 (with 47's) receiver.) See also the Case Histories listed for the RCA R-73 (with 47's) receiver

Weak reception, Motorboating sound, Whistling or squealing	1)	replace *entire* filter block (do not replace only any individual sections that may test "faulty")

GENERAL ELECTRIC J-83-A

(Uses same chassis as RCA R-73 (with 2A5's) receiver.) See also the Case Histories listed for the RCA R-73 (with 2A5's) receiver

Weak reception, Motorboating sound, Whistling or squealing	1)	replace *entire* filter block (do not replace only any individual sections that may test "faulty")

GENERAL ELECTRIC A-85

Inoperative, Weak reception	1)	check voltage across 3,000-ohm first-audio cathode resistor. If less than 2 or 3 volts, replace the electrolytic condenser by-passing this section. Use a 5 to 10 mfd. 25-volt unit
Distortion (sounding like speaker out of alignment)	1)	check all units of volume control and tone clarifier network *C30, C31, R11,* etc. for fault

GENERAL ELECTRIC J-85

(Uses same chassis as RCA-R-12 receiver.) See also the Case Histories listed for the RCA R-12 receiver

Weak reception, Motorboating sound, Whistling or squealing	1)	replace *entire* filter block (do not replace only any individual sections that may test "faulty")

GENERAL ELECTRIC K-85

(Uses same chassis as RCA-240 receiver.) See the Case Histories listed for the RCA-240 receiver

GENERAL ELECTRIC 86 Series

Noises like static but station cannot be tuned in	1)	condenser in "Sentry box" under 6A8 tube "shorted". Unsolder all leads on Sentry box, remove front dial screws, lift up dial assembly, pull out band shaft, remove front section of sentry box from bottom

GENERAL ELECTRIC A-86

No signals on all bands, Static	1)	short-circuited 0.1-mfd. condenser (*C-80*) in "sentry box" (part *No. RC-096*)
Inoperative on "C" band, (operates perfectly on all other bands)	1)	open-circuited 0.0013-mfd. condenser (*C21*), preventing the receiver from oscillating on that band
Loss of volume, Poor selectivity, (abnormally high screen voltage on '6K7 i-f tube)	1)	open-circuited 10,000-ohm resistor section (*R18*) or tapped resistor (*R11, R17, R18*)

GENERAL ELECTRIC B-86

(Uses same chassis as RCA 241-B receiver.) See the Case Histories listed for RCA 241-B receiver

GENERAL ELECTRIC E-86

Same Case Histories as those listed for General Electric E-81 receiver

GENERAL ELECTRIC J-86

(Uses same chassis as RCA R-72 receiver.) See also the Case Histories listed for the RCA R-72 receiver

Weak reception, Motorboating sound, Whistling or squealing	1)	replace *entire* filter block (do not replace only any individual sections that may test "faulty")

GENERAL ELECTRIC M-86

(Uses same chassis as RCA-242 receiver.) See the Case Histories listed for the RCA-242 receiver

GENERAL ELECTRIC A-87

See also the Case Histories listed for General Electric A-82 and A-86 receivers

Inoperative ("sentry box" smoking)	1)	"shorted" 0.1-mfd. 200-volt condenser and burned out 10,000-ohm ½-watt resistor—both fastened on the switch assembly in the foremost of the three sentry boxes. Demount sentry box by removing side fastening bolts, dial-mechanism nuts and the terminal leads. The band-switch shaft must be removed before box cover can be lifted. When box is removed from chassis, disengage the dial gears and remove shaft by lifting the reduction drive and the dial assembly. This allows switch-shaft gear to pass the dial-scale gear when the shaft is pulled straight out. Replace resistor and condenser, using a 0.1-mfd. 400-volt condenser. When re-mounting the switch and dial mechanism, make sure they are in the correct position—otherwise the calibration of the receiver will be destroyed
Inoperative, Weak reception	1)	check for "shorted" 0.05-mfd. condenser and charred 2,000-ohm resistor inside second i-f can
Fading	1)	check volume control

GENERAL ELECTRIC H-87

Difficulty in setting up push-buttons	1)	check for broken wire on push-button oscillator coil. Also spread shaft and make sure of correct angle to insure tight push-button knobs

GENERAL ELECTRIC J-87

(Uses same chassis as RCA R-75 (with 47's) receiver.) See also the Case Histories listed for the RCA R-75 (with 47's) receiver

Weak reception, Motorboating sound, Whistling or squealing	1)	replace *entire* filter block (do not replace only any individual sections that may test 'faulty")

GENERAL ELECTRIC J-87-A

(Uses same chassis as RCA R-75 (with 2A5's) receiver.) See the Case Histories listed for the RCA R-75 (with 2A5's) receiver

Weak reception, Motorboating sound, Whistling or squealing	1)	replace *entire* filter block (do not replace only any individual sections that may test "faulty")

GENERAL ELECTRIC A-88

Same Case Histories as those listed for General Electric A-86 receiver

GENERAL ELECTRIC F-88

Late-production changes for improving the receiver	1)	the 6A8 screen resistor (*R-4*) has been changed from 2,200 ohms to 4,700 ohms
	2)	by-pass condenser (*C-23*) has been disconnected from second i-f screen and connected to screen of first i-f tube
	3)	second i-f screen has been connected to the converter and first i-f plate-supply lead through a 68,000-ohm dropping resistor (*R-4A*) which has been by-passed by a 0.05-mfd. 400-volt condenser (*C-23A*)
	4)	resistance (*R-20*) in series with crystal pickup has been reduced from 270,000 ohms to 39,000 ohms. The parallel resistance (*R-21*) has been reduced from 220,000 ohms to 100,000 ohms. The parallel capacity (*C-39*) has been increased from 0.0005 mfd. to 0.002 mfd.

GENERAL ELECTRIC J-88

Fading, Intermittent reception	1)	open-circuited or leaky r-f, 1st detector and i-f secondary-return by-pass condensers
Whistling, Motorboating, Station hiss	1)	corroded condenser-gang rotor contacts
	2)	open-circuited r-f, 1st detector and i-f secondary-return by-pass condensers
Motorboating sound	1)	leaky r-f, 1st detector, and i-f secondary-return by-pass condensers

GENERAL ELECTRIC M-89

(Uses same chassis as RCA-341 receiver.) See the Case Histories listed for the RCA-341 receiver

GENERAL ELECTRIC A-90

(Uses same chassis as RCA M-30 receiver.) See the Case Histories listed for RCA M-30 receiver

GENERAL ELECTRIC E-91

Same Case Histories as those listed for the E-81 receiver

GENERAL ELECTRIC H-91

Whistling or squealing	1)	"open" or "shorted" 1-mfd. condenser connected across the 170-ohm r-f cathode resistor. If it is "shorted", also check the 18,000-ohm r-f screen bleeder resistor (cathode to screen). If this is "open", screen grid voltage will be high

GENERAL ELECTRIC E-95

Same Case History as that listed for General Electric E-81 receiver

GENERAL ELECTRIC F-96

Depressing a tuning button does not release the button which was depressed previously	1)	check the latch-bar spring. If there is only one spring, and that spring is in the center of the latch bar, *decreasing* the tension will remedy the trouble. Another solution is to replace the center spring with two springs, one at each end of the latch bar. They should have approximately the same tension. Make sure that the ears on the latch bar are twisted sufficiently to reduce, to a minimum, all play in the direction of key movement
Trimmers do not cover the high-frequency range assigned to them	1)	inspect the trimmer for a bent lug. The lug may be bent in such a manner that the trimmer plates do not separate sufficiently to reach minimum capacity. It will be found that stability is better if care is exercised to operate the trimmers near maximum capacity where possible, rather than using the trimmer of the next higher range and thus operating that trimmer at minimum capacity

GENERAL ELECTRIC G-97

Push-buttons stick	1)	loosen tension spring fastened to latch bar at end of the switch

GENERAL ELECTRIC J-100

(Uses same chassis as RCA R-74 receiver.) See also the Case Histories listed for the RCA R-74 receiver

Weak reception, Motorboating sound, Whistling or squealing	1)	replace *entire* filter block

GENERAL ELECTRIC E-101

Same Case History as that listed for General Electric E-81 receiver

GENERAL ELECTRIC 105 Series

Weak (no Colorama tuning)	1)	replace the 5Z4 rectifier
Calibration "off"	1)	check AFC, 6J7 and 5Z4 tubes before adjusting trimmer condensers
Transformer hums and overheats	1)	loosen transformer bolts and insert strips of cardboard between transformer and chassis; tighten bolts
	2)	connect a 500-ohm 10-watt resistor in series with centertap of power transformer

GENERAL ELECTRIC E-105

Same Case History as that listed for General Electric E-81 receiver

GENERAL ELECTRIC G-105

Push-button tuning inoperative	1)	check for "open" 60-mfd. 40-volt dry a-c electrolytic condenser (*C-51*) connected across tuning motor
Noisy while tuning	1)	for electrical noise, clean motor rim contacts with carbon tetrachloride
	2)	for mechanical noise lubricate the rods on which the moving members slide immediately behind the dial
Volume varies slowly	1)	check plate resistor of 6F5 tube for change in value

GENERAL ELECTRIC J-105

(Uses same chassis as RCA R-76 receiver.) See the Case Histories listed for the RCA R-76 receiver

GENERAL ELECTRIC K-105

(Uses same chassis as RCA-261 receiver.) See the Case Histories listed for the RCA-261 receiver

GENERAL ELECTRIC E-106

High noise level—1) break cathode connection of 6K7 first i-f tube and bias through a 10,000-ohm ½-watt resistor. By-pass with a 0.05-mfd. condenser

GENERAL ELECTRIC G-106

See also Case History listed for G-105 receiver

Intermittent reception—1) check for faulty volume control
2) check for leakage in 6F5 tube

Dial pointer moves only in one direction (tuning motor operation O.K.)—1) loosen set-screws of rubber friction bushing on motor shaft and push it forward so it presses more firmly against drive wheel associated with tuning condenser. Tighten set-screws
2) clean selector rim and contacts at rear of tuning condenser with carbon tetrachloride

GENERAL ELECTRIC K-106

(Uses same chassis as RCA R-90 receiver.) See the Case Histories listed for the RCA R-90 receiver

GENERAL ELECTRIC M-106

(Uses same chassis as RCA-262 receiver.) See the Case Histories listed for the RCA-262 receiver

GENERAL ELECTRIC F-107

Automatic tuner unit operates unsatisfactorily—skipping past stations—1) "Touch Tuning" button leads not making good contact to adjustable contact pins. Clean contacts and re-insert
2) sliding contactor blade either covered by thin piece of bakelite or dirty. Carefully run fine file over top of sliding contactor, making sure not to leave any sharp corners. Sliding contactor should have a small amount of vaseline on beveled surface to prevent chattering
3) nipple too sharp on adjustment contacts will cause sliding contactor blade to jump across. Smooth with fine sand paper
4) relay armature out of adjustment causing sluggish operation of relay switch. Adjust the relay . . . Backstop for relay armature should be adjusted so that a potential of 4.5 volts is sufficient to snap relay closed. The backstop must make positive contact with armature when relay is open. If the relay will not close at 4.5 volts and still maintain proper travel and sequence, weaken the spring holding armature open. After any adjustment on relay, sequence in which contacts open should be checked to open in the order described in paragraph No. 1 under "noise in audio output" (see below)
5) excessive side play in sliding contactor. Loosen the set-screw on the back of the sliding contactor, and slide holder together. Final adjustment should allow sliding contactor to rock freely

(Cont'd)

GENERAL ELECTRIC F-107—*(Cont'd)*

Automatic tuner unit operates unsatisfactorily—skipping past stations—*(Cont'd)*—6) not enough tension on sliding contactor arm. Loosen collar on shaft in rear of contact segment and move sliding contactor arm towards the contact segment; then tighten collar on shaft
7) if the contacts at the rear of the "Touch Tuning" button assembly shafts do not close or make good contact, the motor will continue to scan the dial without stopping at the desired station. Adjust by bending contacts
8) contact segment may be bent out of shape. This should be perpendicular to chassis deck and parallel to rear chassis apron in order to allow the contactor arm to wipe the adjustable contacts evenly
9) contacts at rear of the button shafts touching, or, shaft is touching contact. Adjust by bending contacts

No action when station button is pressed—1) relay remains energized and audio continues to function—push button escutcheon grounded. Be sure dial and push button escutcheons are insulated from each other or from the control shafts
2) "Off" switch contacts do not close
3) if set does not tune automatically unless scan button is also depressed, contacts No. 6 require closer spacing
4) open or shorted motor capacitor—characterized by motor armature "humming" but no torque. Replace 1,000-mfd. capacitor *C58*
5) open or shorted coil in motor—characterized by no torque or low torque in one direction. Replace motor or repair coil
6) drive mechanism bound, or too tight for motor to drive
7) not enough friction in Slip Pulley—the friction of the Slip Pulley is adjusted by tightening the collar on the end of the motor shaft. Care should be exercised that the set-screw does not hit the relay armature
8) belt slippage—the tension of the belt may be increased by raising the motor on the relay bracket. If the belt still slips, reverse belt and use other surface or use belt dressing. (Unsatisfactory operation of the automatic tuner unit on some of the earlier models is caused by a slipping drive belt. A small hole drilled through the back corner of the motor base plate and a tapped hole into the chassis will enable a small screw and spring to be used as a belt tightening unit to secure the proper tension)
9) push-button escutcheon "grounded" to chassis of set. This trouble is usually caused by control shafts touching escutcheon. Centering chassis in cabinet, or placing fibre sleeves on shafts will remedy this trouble. This trouble is characterized by the relay remaining closed

Noise in audio output while "Touch Tuning"—1) contacts of switch not opening in proper sequence — if the relay switch contacts open in improper sequence, audio output will be available too soon, and the break in the motor switch will be heard in the speaker. Center contacts (motor) should open *first*, contacts farthest from armature (AFC) *second*, and contacts nearest armature (silent tuning) should open *last*
2) "dressing" of Silent Tuning Lead — early production receivers had silencing lead from 6L6 grid run to connector

(Cont'd)

GENERAL ELECTRIC F-107—*(Cont'd)*

Noise in audio output while "Touch Tuning" —*(Cont'd)*		socket on rear apron, up to "Push Button" switch, and return through socket connector to the relay switch where the ground wires of AFC, motor and silent tuning contacts were connected together and grounded to chassis. Reconnect as follows: Ground AFC and motor contacts to a point of the chassis directly underneath the motor. The green grid lead from the 6L6 should be rewired over the top of the chassis deck to the silencing contact of the relay switch; the lead from the other relay silencing contact should be connected to a prong of the connector plug; from this point, connection is made to the silencing portion of the "Touch Tuning" switch, and a return to ground from this point is made through the connector plug to the chassis near the connector plug socket
	3)	noise through filter circuit—the "blurp" in the speaker on early production due to the sudden application of audio may be reduced by placing a .05-mfd., 600-volt capacitor (*RC-092*) across the output filter capacitor (*C-61*)
"Touch Tuning" button will not remain in locked position	1)	the springs at each end of the latch bar are not in proper adjustment. They should exert an equal pull on each end
Hum when relay is energized	1)	the pole-piece of the relay is divided to form two semi-circles. The relay armature should touch only the semi-circle nearest the motor shaft. There should be a 10-mil clearance between the other segment and relay armature when the relay is energized. Bending the entire armature support may correct this condition, otherwise the pole-piece should be filed down. Hum may also be caused by a bump on the segment with which the armature comes in contact. This may be removed by filing. Be sure all filings are removed after adjustments have been made After any adjustment on relay, sequence in which contacts open should be checked to open in the order indicated below
Motor inoperative	1)	center contacts on relay not making good contact
	2)	faulty motor-reversing switch
	3)	"cold-solder" connection on motor-reversing switch
	4)	"open" or "shorted" coil in motor — this will be evidenced by no torque, or low torque in one direction only
Motor hums, but no torque	1)	"shorted" motor capacitor. Replace with 1000-mfd. 12-volt unit (A.C. working voltage)
Motor slows down, almost stopping	1)	replace 1000-mfd. 12-volt motor capacitor
Intermittent operation	1)	check the pilot light socket and bracket assembly for "shorts"
Low-frequency stations weak or inaudible	1)	"shorted" 580-kc padder
Motorboating sound when station is tuned in by means of buttons	1)	A.F.C. out of line. Adjust hex nut on A.F.C. transformer, until "pull-in" is equal on both sides of station carrier

(Cont'd)

GENERAL ELECTRIC F-107—*(Cont'd)*

Excessive hum (volume control off)	1)	reverse voice coil leads on speaker
	2)	make sure both contacts for plates of 5Z3 rectifier are making good contact
Miscellaneous adjustments	1)	the fork on the tuning condenser should be adjusted so that the motor reversing switch clicks over when the pointer approximately reaches the 540 and 1620 kc. markings on the dial scale. With the pointer at the extreme end of calibrations when tuning manually, the reversing switch lever should be set so there is not more than 1/16 in. nor less than 1/32 in. clearance between the lever and the switch trigger after the switch has snapped
	2)	the motor and relay mounting plate should rest parallel to the chassis deck. Do not adjust the spring tension foot; raise or lower motor on bracket, as required. Make sure that there is no electrical connection between the motor frame and the chassis
	3)	the "Off" switch on the "Touch Tuning" assembly should stay closed for at least one-half the movement of the key, opening only on the final click. If firm contact does not exist between the points, vibration of the set may cause an intermittent noise
	4)	the silent tuning contacts of the "Manual" and "Scan" switches should open last to permit quiet operation

GENERAL ELECTRIC J-107

(Uses same chassis as RCA R-77 receiver.) See also the Case Histories listed for the RCA R-77 receiver

Weak reception, Motorboating sound, Whistling or squealing, Stuttering reception,	1)	replace *entire* filter block, even though only a few sections test faulty

GENERAL ELECTRIC K-107

(Uses same chassis as RCA-260 receiver.) See the Case Histories listed for the RCA-260 receiver

GENERAL ELECTRIC M-107

(Uses same chassis as RCA-263 receiver.) See also the Case Histories listed for the RCA-263 receiver

Crackling noises	1)	check for faulty push-pull transformer between driver and output stages

GENERAL ELECTRIC J-109

(Uses same chassis as RCA R-81 receiver.) See also the Case Histories listed for the RCA R-81 receiver

Intermittent reception, Inoperative	1)	open-circuiting or open-circuited 0.1-mfd. audio coupling condenser
Intermittent radio or phono reception	1)	corroded contact segments at master change-over switch
Fading Sharp drop in volume, Weak reception, Station hiss	1)	open-circuited 0.05-mfd. r-f, first detector and i-f secondary-return by-pass condensers

(Cont'd over)

GENERAL ELECTRIC J-109—*(Cont'd)*

Poor control of volume, Distortion, Distortion at resonance	1)	leaky 0.05-mfd. r-f, first detector and i-f secondary return by-pass condensers
Noisy tuning, Whistling, Motorboating sound between stations	1)	corroded condenser-gang rotor contacts. Bond rotor to chassis with flexible pigtails
Inoperative home-recording meter	1)	remove meter and decrease tension upon pivot of meter needle

GENERAL ELECTRIC H-116

Weak reception on broadcast band	1)	change 47-mmfd. oscillator coupling condenser (*C-14*) to one of 100-mmfd. capacity for more perfect adjustment
Whistling, Squealing, Intermittent reception	1)	faulty 6SQ7 tube that may not show up faulty in a tube tester. Try new tube
Difficult to set up push-buttons	1)	check for broken wire on button oscillator coil. Also spread shaft and make sure of correct angle so button knobs will be tight

GENERAL ELECTRIC H-118

Continual frying noise with volume control at either minimum or maximum setting	1)	induction from a-c transformer leads running under resistors. Using an insulated screwdriver, move the leads down, or out, until the noise stops
Difficult to set up push buttons	1)	check for broken wire on button oscilator coil. Also spread shaft and make sure of correct angle so button knobs will be tight

GENERAL ELECTRIC 125 Series

Fading, Sharp drop in volume, Weak reception, Station hiss	1)	open-circuited 0.1-mfd. r-f, first detector and i-f secondary-return by-pass condensers
Fading, Dial settings incorrect	1)	snapped tabs on oscillator series condenser
Poor control of volume, Distortion, Distortion at resonance	1)	leaky 0.1-mfd. r-f, first detector and i-f secondary-return by-pass condensers
Noisy tuning, Whistling, Motorboating sound between stations	1)	corroded condenser-gang rotor contacts. Bond rotor to chassis with flexible pigtails
Mechanical hum	1)	loose laminations of filter choke—heat in oven, press together, allow to cool
Noisy reception	1)	noisy volume control

GENERAL ELECTRIC A-125

Inoperative	1)	no voltage on '6L7 screen. Replace "shorted" 0.05-mfd. screen by-pass condenser
	2)	no '6L7 plate voltage. Replace "shorted" 0.05-mfd. plate-return bypass condenser and 2000-ohm plate-return isolation resistor

(Cont'd)

GENERAL ELECTRIC A-125—*(Cont'd)*

Inoperative (audio amplifier alive)	1)	short-circuited type '6K7 tube in AVC circuit
Inoperative (with tone control in the extreme "bass" position)	1)	"leaky", or "shorted" 0.08-mfd. tone-control condenser
Sensitivity control inoperative in any position	1)	check the position of the '6A8 bias resistor within the "sentry box". The lead of this carbon resistor (soldered to a lug on the terminal strip) often "grounds" to the case of the long-wave band "padding" condenser
No DX reception	1)	short-circuited "permaliner" i-f trimmer condenser. Test each circuit in chassis separately with oscillator to trace this trouble
Fading	1)	"flash" either of the i-f primary trimmers to chassis with a screwdriver. Trouble is due to internal "shorting" and "leakage" in the air-tuned i-f trimmer condensers ("Permaliners") employed. Replace these condensers if necessary
High sensitivity, Crackling, No AVC action	1)	"shorted" 0.05-mfd. 200-volt screen-grid by-pass condenser of the 6K7 AVC amplifier stage. Replace with a unit of higher voltage rating
Whistling (on high-frequency bands)	1)	replace the grid resistor (*R-11*) in the oscillator circuit with one of 50,000 ohms
	2)	place small, soft rubber washers on the speaker mounting bolts both in front and in back of the speaker. A metal washer should be placed over the rear one before the nut is replaced
Noisy reception	1)	tighten the bolts fastening i-f shield cans to chassis. Placing lock-washers under bolts will avoid future trouble
Poor tone on "E" band (18—40-mc)	1)	no fault of receiver. Due to inadvertent frequency-modulation of transmitter
Tuning dial off calibration, Tuning meter functions erratically or not at all, Low volume, Poor tone, Poor short-wave reception	1)	defective type '6L7 tube. (Even though it tests O.K.). Replace with new tube
	2)	2) check the 0.05-mfd. condenser (*C-64*) between G-2 and G-3 of the 6K7 AVC i-f amplifier for a "shorted" condition. When replacing, also check 5,000-ohm resistor (*R-29*) as this resistor overheats when the condenser shorts
	3)	after the trouble has been located and corrected, recalibrate or reset the pointer

GENERAL ELECTRIC J-125

(Uses same chassis as RCA R-78 receiver.) See the Case Histories listed for the RCA R-78 receiver

GENERAL ELECTRIC J-125-A

(Uses same chassis as RCA R-78(2) receiver.) See the Case Histories listed for the RCA R-78(2) receiver

GENERAL ELECTRIC M-125

(Uses same chassis as RCA-281 receiver.) See the Case Histories listed for the RCA-281 receiver

GENERAL ELECTRIC E-126

Insensitive (E-126 receiver)	1)	"shorted" 0.05-mfd. by-pass in plate circuit of 6L7 mixer tube
	2)	burned 2,200-ohm resistor inside first i-f transformer
Noisy volume control (E-126 receiver)	1)	before replacing volume control, try replacing 6C5 first a-f tube
Record changer skips records (E-129 receiver)	1)	stretch spring on tone arm slightly to improve ratchet action. Adjust setscrew on record lift lever
"Silent Tuning" switch does not entirely silence receiver	1)	clean contacts of the "Silent Tuning" switch, and spread a thin layer of solder on each outer blade of the switch to stiffen them

GENERAL ELECTRIC K-126

(Uses same chassis as RCA-280 receiver.) See the Case Histories listed for the RCA-280 receiver

GENERAL ELECTRIC M-128-R

(Uses same chassis as RCA-380 Duo H. R. receiver.) See the Case Histories listed for the RCA-380 Duo H. R. receiver

GENERAL ELECTRIC E-129

Same Case Histories as those listed for General Electric E-126 receiver

GENERAL ELECTRIC M-129

(Uses same chassis as RCA-381 receiver.) See the Case Histories listed for the RCA-381 receiver

GENERAL ELECTRIC S-132

(Uses same chassis as RCA R-10 receiver.) See also the Case Histories listed for the RCA R-10 receiver

Distortion	1)	if distortion clears up when dial is turned a bit either side of resonance, check 745-mfd. condenser in series-parallel arrangement across oscillator coil

GENERAL ELECTRIC F-135

See also the Case Histories listed for General Electric F-107 receiver

Automatic tuning inoperative (manual tuning O.K.)	1)	tap the relay on the left front side (looking at chassis from rear) to "free" the contacts. If still inoperative, clean and adjust the relay contacts

GENERAL ELECTRIC E-155

See also Case Histories listed for General Electric E-126 receiver

Fuses blow	1)	faulty 5Z4 rectifier tube
Inoperative	1)	"open" 50-ohm resistor in one of the two 5Z4 plate circuits. These resistors are connected from the secondary high-voltage windings to one of the plates of each 5Z4 rectifier tube. Use 50-ohm 25-watt resistors for replacement
Pilot light bulbs burn out frequently	1)	pull out the speaker plug, remove the chassis. Unsolder the *black* lead connected to the bank of pilot bulbs, and insert a 1-ohm resistor in series with it to reduce the voltage applied to the pilot light bulbs

(Cont'd)

GENERAL ELECTRIC E-155—*(Cont'd)*

Motorboating sound followed by normal operation for a few minutes, then a thump, followed by poor tone	1)	poor welded ground connection of the triple-section condenser in the corner close to the 6L6 tubes. This connection is under a group of by-pass condensers Bond the condenser to the chassis
Insensitive on distant stations—local station reception O.K.	1)	check for "shorted" 0.05-mfd. by-pass condenser (*TC No. 40*) in grid circuit of first i-f transformer
	2)	check 10-mfd. 25-volt bias condenser in 6F6 driver stage for loss in capacity

GENERAL ELECTRIC R-155

High noise level	1)	break cathode connection of 6K7 first i-f tube and bias it through a 10,000-ohm ½-watt resistor. Bypass this with a 0.05-mfd. condenser

GENERAL ELECTRIC LRP-158 Automatic Record Changer

Tone arm continues to repeat playing top record of stack, Tone arm jams when part way in on record	1)	take all records off the posts. Loosen the setscrew on the record separator segment. Set the record separator segment so that the index finger of the pickup arm return lever rides on the middle of the segment. Rotate the cam until it is in such a position that the index finger will never ride off either end. Check to see that the index finger rides in over top of the cam when the record shelf is depressed by the weight of one record. Tighten the setscrew
	2)	record separator shaft, or the spring on which it rests, is binding on the shaft bushing
	3)	pin on record separator shaft binding in its slot
	4)	shaft spring too weak
Sapphire does not land at correct point on 10- and 12-inch records	1)	correct landing distance from outside edge of spindle to sapphire is 4 11/32 inches for a 10-inch record. Place a ten-inch record on the turntable and rotate the changer through cycle until the sapphire is just ready to land. Make sure that the index finger of the pickup arm return lever is against the record separator shaft and that the tone arm trip lever stud is held firmly against the return lever. Loosen the two setscrews in the collar on the pickup arm spindle and move the pickup arm to the correct landing position. See that there is a 3/32 inch clearance between the pickup arm bearing and the setscrew collar. Tighten the *zinc-plated* screw, run the changer through cycle several times as a check, then tighten the *copper-plated* screw. The twelve-inch landing position is automatically maintained
	2)	feed-in spring bent too far in front of tone arm return lever
Mechanism jams, General irregularity of landing of 10- and 12-inch records and other operations	1)	with the ratchet lever and the pawl on the drive shaft cam in playing position, remove the bottom support bracket. Remove the washer on the main cam shaft, and slip the cam down far enough that it can be rotated with respect to the drive gear. Then rotate it until the timing notch is positioned. Put the main gear back in mesh with the drive gear, replace the washer, and place the elevating lever on the cam ridge. Make certain the separator lever train is in its correct position and replace the bottom support bracket
	2)	unsufficient tension on belt

(Cont'd)

GENERAL ELECTRIC LRP-158 Record Changer—*(Cont'd)*

Turntable does not turn freely, Slow speed	1)	loosen the two screws in the bottom bearing plate and position the plate until the turntable revolves freely. Tighten screws and check by applying a-c to the turntable motor, then shutting it off and noting that the turntable continues to make at least twelve revolutions freely
	2)	incorrect tension on motor support spring
Records strike separator post, Records fail to stay on record shelf	1)	turn the record support post to the ten-inch position. Loosen the two setscrews which hold the separator post against the end of its slot in the motorboard and turn the belt drum to take up any slack in the belt. Tighten the *zinc-plated* blunt-nosed screw and check to see that a ten-inch record fits the posts as shown. Then tighten the *copper-plated,* cone-pointed screw The twelve-inch position is automatically maintained (in the Model LRP-158 changer only. In the Model LRP-160 changer, the twelve-inch position is adjusted after that of the ten-inch, by changing the support post to take the twelve-inch record, and turning the eccentric stop until the edge of the record is halfway up on the record support bevel while the other edge is against the record separator post
Records do not drop at proper time	1)	place a ten-inch record on the posts. Loosen the two set-screws in the collar at bottom of record separator shaft, and turn the shaft until the edge of the record-separating knife is one-eighth inch away from the edge of the record. The teeth on the inner circumference of the knife should be resting in the bottom of their slots at the time the adjustment is made. Tighten the *zinc-plated* screw first, run through cycle several times as a check, then tighten the *copper-plated* screw
Top of pickup arm strikes stack of records, Sapphire fails to clear records or turntable	1)	rotate the changer through cycle until the pickup arm has risen to its maximum height above the turntable but has not begun to move out. At this point loosen the locknut and adjust the screw on the tone arm lift lever until the distance between the turntable and the sapphire is one and three-sixteenths inch. Tighten the locknut on this screw
Sapphire strikes the motorboard	1)	bend pickup arm support bracket until the sapphire clears the motorboard by about $\frac{3}{32}$ of an inch
Mechanism jams, Tone arm continues to come down in rest position	1)	make adjustment specified previously for symptom *"Tone arm continues to repeat playing top record of stack"*
	2)	record separator shaft, or spring on which it rests is binding on the shaft bushing
	3)	pin on record separator shaft is binding in its slot
	4)	shaft spring is too strong
Loud "clicking" noise resulting from drive cam pawl slipping out of teeth in cam wheel	1)	check mechanism timing adjustment. Make certain that pickup arm lever is not binding on its stud. Any jamming will cause the clutch to slip and produce clicking sound
Repeats grooves	1)	binding in tone arm support post
Record stack unsteady	1)	bottom record not supported evenly at two points on support. Clean support

GENERAL ELECTRIC LRP-160 Automatic Record Changer

See also Case Histories listed for General Electric LRP-158 Automatic Record Changer

Turntable fails to start	1)	check spacing of stop switch contacts to be certain that weight of "stop" button does not open them
Mechanism fails to start, Automatic stop switch is inoperative in "automatic" position	1)	set the control lever to *"Automatic."* Loosen setscrew on control cam, and move the control can until the stud on stop switch is centrally located. Tighten setscrew
Turntable does not stop automatically	1)	check for binding in "stop" button bushing
	2)	bend flat bracket that limits outward movement of trip lever, so that pickup lands on the "stop" button
Mechanism trips continuously	1)	check to see that the rachet lever engages the dirve cam pawl properly at end of change cycle. Bend lever if necessary
	2)	bend the control cam flat spring for greater pressure
No output or noise during entire cycle	1)	loosen two screws in pickup shorting switch. Position the switch to obtain $\frac{3}{32}$-inch clearance between the switch blades when the tone arm is in playing position. Tighten the screws. Make certain that the pawl is on the correct side of the long leaf spring in the shorting switch

GENERAL ELECTRIC LRP-162 Automatic Record Changer

See also Case Histories listed for General Electric LRP-158 Automatic Record Changer

Mechanism trips continuously	1)	check to see that the rachet lever engages the drive cam pawl properly at end of the change cycle. Bend the lever if necessary
Separator knife jams on last record of stock	1)	check separator knife edge. It should not be sharp enough to dig into the record and carry the record up with it. If too sharp, dull the edge slightly with fine emery cloth
Sapphire fails to track in record groove, Distortion	1)	guard screw at bottom of pickup head strikes record
	2)	sapphire loose or damaged
Incorrect pickup feed-in	1)	feed-in spring bent too much, or too little. Spring does not have any effect until just after the pickup has landed on the record. It then springs back to its original shape, pushing against the trip lever stud and moving the pickup toward the music grooves

GENERAL ELECTRIC A-205, A-208

Tuning dial off calibration, Tuning meter functions erratically or not at all, Low volume, Poor tone, Poor short-wave reception	1)	see the Case History for this same trouble listed for General Electric A-125 receiver
Distortion, Poor tone	1)	improper phasing of dual speakers. Reverse connections on one of voice coils

(Cont'd)

GENERAL ELECTRIC A-205, A-208—*(Cont'd)*

Speaker rattle or "buzz"	1)	unevenly tightened speaker mounting bolts. Speaker cone warps as a result of an excessively tightened bolt, causing the voice coil to be thrown off center

GENERAL ELECTRIC H-400

Inoperative (tubes, voltages, etc., O.K.)	1)	check for "open" volume control
Dial light burns out frequently	1)	check for "short" in 35Z5 tube

GENERAL ELECTRIC HB-402, HB-403

Distortion	1)	check 1-meg. volume control for increase in value to 3 or 4 megohms. Replace

GENERAL ELECTRIC HB-504, HB-505

Inoperative (all voltages O.K.)	1)	oscillator inoperative due to "shorting" of one or more turns of grid winding of oscillator coil. Try squeezing coil with hand to see if this clears short and permits reception. Replace coil

GENERAL ELECTRIC LB-530

Reception chokes, then stops altogether	1)	faulty output tube grid-bias cell. Replace cells. Also try new 1Q5GT tube

GENERAL ELECTRIC HJ-618 (AC)

Weak reception, Receiver off calibration and difficult to align properly	1)	check wiring of receiver for a 0.004-mfd. mica condenser connected from junction of 47-mmfd. condenser *C-16* and padder *C-3* to ground. This unit is not shown in schematic diagrams. If it exists in the receiver, remove it

GENERAL ELECTRIC H-625, H-630, H-631, H-632, H-633

60 cycle modulation hum on carrier wave	1)	check for "open" choke (*L8*) connected from antenna circuit to one side of a-c line. Replace with any r-f choke coil of about same size

GENERAL ELECTRIC H-639 (AC)

Inoperative, Noisy operation	1)	check for loose or dirty contacts in phono-radio switch connected mechanically to the pickup arm
Intermittent operation	1)	check for intermittently "open" coupling condenser from plate of 6J5 to grid of 25L6GT tube
	2)	replace oscillator grid resistor with 50,000-ohm ½-watt unit
Noisy reception	1)	check for "open" in second i-f transformer
	2)	check for rubbing voice coil
Phono turntable inoperative	1)	broken spring on function wheel
	2)	phono needles jamming phono motor

GENERAL ELECTRIC 700

Same Case Histories as those listed for RCA Radiola 80 receiver

GENERAL ELECTRIC J-718, J-728, J-808, J-809, J-818, J-828

Irregularity of operation of record changer	1)	for any irregularity of operation of the automatic record changer, check the adjustment of main lever *No. 15* as follows: *A. Main Lever.*—This lever is basically important in that it interlinks the various individual mechanisms which control needle landing, tripping, record separation, etc. One adjustment is provided for the main lever. Rotate the turntable until the changer is out-of-cycle; and adjust rubber bumper bracket so that the roller clears the nose of the cam plate by 1/16 inch
Failure to trip at end of record	1)	increase clutch *No. 5* friction by means of adjusting screw
Needle does not "track" after landing	1)	friction clutch adjustment screw may be too tight
	2)	tone arm vertical bearing "binding"
	3)	pick-up output cable twisted
Cycle of record changer starts before record has been completely played	1)	faulty record
	2)	adjustment of friction clutch is too tight
"Wow" in record reproduction	1)	faulty record
	2)	instrument not being operated at normal room temperature (65°F)
	3)	check for oil, grease, or dirt on driving wheel or idler pulley rubber tire. The motor support mounting bracket "N" should be moved in its mounting holes until motor spindle is parallel to the turntable spindle and exactly at right angles to the main driving wheel (*"29"*). The bracket mounting nuts should then be securely tightened

GENERAL ELECTRIC JZ-835

(Uses same chassis as RCA RO-23 receiver.) See the Case Histories listed for the RCA RO-23 receiver

GENERAL ELECTRIC HJ-905

Hum	1)	connect a 0.05-mfd. 600-volt condenser across power line input circuit

GENERAL ELECTRIC J-1108

Record changer motor inoperative	1)	if motor fails to run when proper voltage is applied directly to the two ends of its windings, it indicates trouble in them. Unless the damage is easily seen and repaired, replace the motor
Record changer motor slow in starting	1)	changer may have been in a very cold place, and may not yet have reached room temperature. Give it a fair chance to get warmed up, before concluding that motor is faulty, and proceeding as in paragraph above.
Record changer mechanism slow in starting, or stalls during a change cycle, but slight forward push with hand starts it again	1)	failure to lubricate properly
	2)	loose setscrews
	3)	weakness of drive (line voltage may be abnormally low or motor windings damaged)
Changer stalls suddenly	1)	rotate turntable backwards ⅛ turn and release. Do not use force. Remove turntable by releasing the two set-screws on pinion (*B*) and lifting turntable. See that motor runs and rubber idler wheel is free and in good condition. Lubricate the turntable spindle with light grease and reassemble. Set in lock pinion (*B*) with top of teeth even with top of teeth in main Cam (*A*).
	2)	check condition of levers and clear any jammed lever.

(Cont'd)

GENERAL ELECTRIC J-1108—*(Cont'd)*

Changer repeats cycle	1)	check latch lever (*E*) and spring
	2)	see that control lever (*H*) clears latch lever (*E*) when control button is in "Auto" position.
Tone arm doesn't drop in proper position when playing 12-inch records	1)	the difference in drop points for 10-inch and 12-inch records is fixed by stop levers (*J-K*). When the Landing Position of the pickup is adjusted to a 10-inch record, it should automatically adjust itself for 12-inch records. Change the stop levers (*J-K*) if they have been damaged
	2)	if tone arm always drops in one position, check toggle lever spring (*W*) inside of stock bracket (*X*)
Improper record feed	1)	check records for warp
	2)	check and level platforms (*Y*). Use flat record and adjust platforms (*Y*) by tightening or loosening the screws
	3)	check selector (*Z*) tip elevation. This should be 1/16 (0.062) inches. Adjust whole selector (*Z*) blade. Do not bend tip
	4)	check timing of selector (*Z*) tips to edge of 12-inch record. They should be approximately ¼ in. from the edge of 12-inch record and should be equally distant from the edge of the record. To adjust loosen the clamp screw on the pinion (*AA*) and swing selector (*Z*) tip away from record. Set to correct position while approaching record and lock clamp screw
"Wow"	1)	remove turntable by releasing the two setscrews on pinion (*B*) and lift turntable and see that rubber idler wheel is not worn or oily. If idler is oily, clean with carbon tetrachloride. Re-lubricate the turntable spindle (*C*) and re-assemble

GENERAL ELECTRIC (*CANADIAN*)* RECEIVERS

GENERAL ELECTRIC (CANADIAN) ALL-WAVE RECEIVERS

Inoperative on "C" or "X" band, (set may operate if switch is snapped hard against the stop), Cleaning or tightening contacts does not improve the switch	1)	warped 7 inch shaft on the wave-change switch. This prevents the rear switch arm from turning far enough, and either the wrong contact or sometimes no contact is made in this section

GENERAL ELECTRIC (CANADIAN) L6CB

(Uses same chassis as RCA-223 receiver.) See the Case Histories listed for the RCA-223 receiver

GENERAL ELECTRIC (CANADIAN) S-22, S-22-X

(Use same chassis as RCA R-7 receiver.) See the Case Histories listed for the RCA R-7 receiver

GENERAL ELECTRIC (CANADIAN) H-31

(Uses same chassis as RCA Radiola 80 receiver.) See the Case Histories listed for the RCA Radiola 80 receiver

GENERAL ELECTRIC (CANADIAN) H-32

(Uses same chassis as RCA R-50 and RCA R-55 receivers.) See the Case Histories listed for the RCA R-50 and RCA R-55 receivers

GENERAL ELECTRIC (CANADIAN) B-40

(Uses same chassis as RCA M-34 receiver.) See the Case Histories listed for the RCA M-34 receiver

* For a Cross-Index of the Model Numbers of General Electric (*Canadian*) with those of corresponding *American* RCA and RCA-Victor, *Canadian* RCA-Victor, and *Canadian* Westinghouse receivers, see the list in *Section 6* of this *Handbook*.

GENERAL ELECTRIC (CANADIAN) M-41

(Uses same chassis as RCA-100 and RCA M-101 receivers.) See the Case Histories listed for the RCA-100 and RCA M-101 receivers

GENERAL ELECTRIC (CANADIAN) T-41

(Uses same chassis as RCA Radiola 48 receiver.) See the Case Histories listed for the RCA Radiola 48 receiver

GENERAL ELECTRIC (CANADIAN) M-42

(Uses same chassis as RCA-100 and RCA M-101 receivers) See the Case Histories listed for the RCA-100 and RCA M-101 receivers

GENERAL ELECTRIC (CANADIAN) S-42

(Uses same chassis as RCA R-8 receiver.) See the Case Histories listed for the RCA R-8 receiver

GENERAL ELECTRIC (CANADIAN) S-42-A

(Uses same chassis as RCA R-7A receiver.) See the Case Histories listed for the RCA R-7A receiver

GENERAL ELECTRIC (CANADIAN) S-42-B

(Uses same chassis as RCA R-43 receiver.) See the Case Histories listed for the RCA R-43 receiver

GENERAL ELECTRIC (CANADIAN) R-44, R-46

Weak reception, Whistling	1)	due to bearing wear, the gang condenser shaft frequently shifts so that the movable plates are not centrally located between the fixed plates. Loosen holding screws for 3 sets of fixed plates and if necessary ream the holes to obtain greater movement. Then center the 2 sets of plates and tighten holding screws. Clean the shield, and tighten the holding springs. Realign receiver

GENERAL ELECTRIC (CANADIAN) K-50

(Uses same chassis as RCA R-28 receiver.) See the Case Histories listed for the RCA R-28 receiver

GENERAL ELECTRIC (CANADIAN) H-51

(Uses same chassis as RCA Radiola 82 receiver.) See the Case Histories listed for the RCA Radiola 82 receiver

GENERAL ELECTRIC (CANADIAN) M-51

(Uses same chassis as RCA-118 receiver.) See the Case Histories listed for the RCA-118 receiver

GENERAL ELECTRIC (CANADIAN) K-52

(Use same chassis as RCA R-28-P, RCA-110, RCA-111 and RCA-115 receivers.) See the Case Histories listed for the RCA R-28-P, RCA-110, RCA-111 and RCA-115 receivers

GENERAL ELECTRIC (CANADIAN) M-52

(Uses the same chassis as RCA-118 receiver.) See the Case Histories listed for the RCA-118 receiver

GENERAL ELECTRIC (CANADIAN) K-53

(Uses same chassis as RCA R-28-P, RCA-110, RCA-111 and RCA-115 receivers.) See the Case Histories listed for the RCA R-28-P, RCA-110, RCA-111 and RCA-115 receivers

GENERAL ELECTRIC (CANADIAN) M-56

(Uses same chassis as RCA-211 receiver.) See the Case Histories listed for RCA-211 receiver

GENERAL ELECTRIC (CANADIAN) K-57

(Uses same chassis as RCA-120 receiver.) See the Case Histories listed for the RCA-120 receiver

GENERAL ELECTRIC (CANADIAN) K-59

(Uses same chassis as RCA-110, RCA-111 and RCA-115 receivers.) See the Case Histories listed for the RCA-110, RCA-111 and RCA-115 receivers

GENERAL ELECTRIC (CANADIAN) K-60

(Uses same chassis as RCA R-37 receiver.) See the Case Histories listed for the RCA R-37 receiver

GENERAL ELECTRIC (CANADIAN) M-61

(Uses same chassis as RCA-128 receiver.) See the Case Histories listed for the RCA-128 receiver

GENERAL ELECTRIC (CANADIAN) K-62

(Uses same chassis as RCA R-11 receiver.) See the Case Histories listed for the RCA R-11 receiver

GENERAL ELECTRIC (CANADIAN) M-62

(Uses same chassis as RCA-121 receiver.) See the Case Histories listed for the RCA-121 receiver

GENERAL ELECTRIC (CANADIAN) K-64

(Uses same chassis as RCA-121 receiver.) See the Case Histories listed for the RCA-121 receiver

GENERAL ELECTRIC (CANADIAN) M-67

(Uses same chassis as RCA-224 receiver.) See the Case Histories listed for the RCA-224 receiver

GENERAL ELECTRIC (CANADIAN) M-69

(Uses same chassis as RCA-121 receiver.) See the Case Histories listed for the RCA-121 receiver

GENERAL ELECTRIC (CANADIAN) H-71

(Uses same chassis as RCA Radiola 86 receiver.) See the Case Histories listed for the RCA Radiola 86 receiver

GENERAL ELECTRIC (CANADIAN) H-72

(Uses same chassis as RCA RAE-59 receiver.) See the Case Histories listed for the RCA RAE-59 receiver

GENERAL ELECTRIC (CANADIAN) K-72

Hum,	1) clean rotor springs on tuning condensers
Whistling or squealing	2) check all by-pass condensers for "open" circuit

GENERAL ELECTRIC (CANADIAN) K-75

Whistling or squealing, Motorboating	1) replace dual condenser entirely

GENERAL ELECTRIC (CANADIAN) K-76

Same Case Histories as those listed for General Electric (Canadian) K-72 receiver

GENERAL ELECTRIC (CANADIAN) H-77

(Uses same chassis as RCA R-7A and RE-16 receivers.) See the Case Histories listed for the RCA R-7A and RE-16 receivers

GENERAL ELECTRIC (CANADIAN) K-79

(Uses same chassis as RCA-331 receiver.) See the Case Histories listed for the RCA-331 receiver

GENERAL ELECTRIC (CANADIAN) K-80

(Use the same chassis as RCA-140 and RCA-140-E receivers.) See the Case Histories listed for the RCA-140 and RCA-140-E receivers

GENERAL ELECTRIC (CANADIAN) M-81

(Uses same chassis as RCA-143 receiver.) See the Case Histories listed for the RCA-143 receiver

GENERAL ELECTRIC (CANADIAN) J-82

(Uses same chassis as RCA R-71 receiver.) See the Case Histories listed for the RCA R-71 receiver

GENERAL ELECTRIC (CANADIAN) K-83

Same Case History as that listed for General Electric (Canadian) K-72 receiver

GENERAL ELECTRIC (CANADIAN) J-85

(Uses same chassis as RCA R-10 and R-12 receiver.) See Case Histories listed for RCA R-10 and R-12 receivers, also those listed for General Electric (Canadian) K-72 receiver

GENERAL ELECTRIC (CANADIAN) J-86

(Uses same chassis as RCA R-72 receiver.) See the Case Histories listed for the RCA R-72 receiver

GENERAL ELECTRIC (CANADIAN) M-86

(Uses same chassis as RCA-242 receiver.) See the Case Histories listed for the RCA-242 receiver

GENERAL ELECTRIC (CANADIAN) K-87

Same Case Histories as those listed for General Electric (Canadian) K-72 receiver

GENERAL ELECTRIC (CANADIAN) J-105

(Use same chassis as RCA R-74, R-76 and R-77 receivers.) See the Case Histories listed for the RCA R-74, R-76 and R-77 receivers

GENERAL ELECTRIC (CANADIAN) K-105

Same Case Histories as those listed for General Electric (Canadian) K-72 receiver

GENERAL ELECTRIC (CANADIAN) K-106

(Uses same chassis as RCA R-90 receiver.) See the Case Histories listed for the RCA R-90 receiver

GENERAL ELECTRIC (CANADIAN) M-106

(Uses same chassis as RCA-262 receiver.) See the Case Histories listed for the RCA-262 receiver

GENERAL ELECTRIC (CANADIAN) J-107

(Uses same chassis as RCA R-74, R-76 and R-77 receivers.) See the Case Histories listed for the RCA R-74, R-76 and R-77 receivers

GENERAL ELECTRIC (CANADIAN) K-107

Same Case History as that listed for General Electric (Canadian) K-72 receiver

GENERAL ELECTRIC (CANADIAN) M-107

(Uses same chassis as RCA 262 receiver.) See the Case Histories listed for the RCA 262 receiver

GENERAL ELECTRIC (CANADIAN) J-125

(Uses same chassis as RCA R-78 receiver.) See the Case Histories listed for the RCA R-78 receiver

GENERAL ELECTRIC (CANADIAN) K-125

Same Case Histories as listed for General Electric (Canadian) K-72 receiver

GENERAL ELECTRIC (CANADIAN) M-125

(Uses same chassis as RCA-281 receiver.) See the Case Histories listed for the RCA-281 receiver

GENERAL ELECTRIC (CANADIAN) K-126

(Uses same chassis as RCA-280 receiver.) See the Case Histories listed for the RCA-280 receiver

GENERAL INDUSTRIES

GENERAL INDUSTRIES Record Changers

Records do not change
1) some records have eccentric grooves that do not permit sufficient lateral reciprocating motion for the pickup arm to operate the trip mechanism. In this case an adjustment of the latch plate located near the base of the pickup) is necessary. This is done by loosening the screw at the outer end of the plate and turning the eccentric washer in a direction that will bring the ratchet closer to the trip mechanism. This must be carefully set so that the trip lever will operate with a very small lateral movement of the pickup arm

Long records change before completion
1) when certain long records change before completion, it may be necessary to make the following repairs: Remove the cotter pin and pawl assembly (located near the base of the pickup), from the pickup assembly. Note whether the record changes when the needle is less than ¼ inch or more than ¼ inch from the end. If the former is the case, the correction may be made by filing about 1/64 in. of the metal away from the side of the pawl that comes in contact with the stop. If the latter is the case, bend the lower arm of the lever holding the pawl slightly, in the direction away from the pickup

Lever fails to remove second last record—or removes last record
1) the lever must be adjusted by loosening its lock nut and turning the set screw until the lever is just the right height to remove all but the last record, just clearing the latter, permitting it to repeat continuously

Motor operates intermittently
1) usually due to a faulty power switch

Erratic speed
1) V in governor composed of a piece of brass and one of steel. File all edges smooth, and square off, so that as governor spins the steel V rides on the brass V and can slide smoothly without catching

Slow
1) if rotation is still slow after governor has been removed, yet spindle turns freely by hand, carefully ream the bronze bushing (not the front or rear bushing) with a fine reamer. Do not ream too much as bearing knock will result. Reassemble

(Cont'd)

GENERAL INDUSTRIES Record Changers—*(Cont'd)*

Oiling
1) apply a few drops of light machine oil (3-in-1 oil is satisfactory) to the motor bearings, governor and to the various bearing surfaces in the trip mechanism

GENERAL MOTORS

GENERAL MOTORS Car Sets of 1934

Motorboating, Steady whistle (in Buick, Chevrolet, Oldsmobile, Pontiac, or United Motors sets of 1934)
1) broken lead from r-f cathode by-pass condenser. Look for largest condenser of cluster of three, jammed between lid and the other two

GENERAL MOTORS 1938 Auto Radios

"Hash" noise between stations in 6-tube single-unit models
1) connect a 0.002-mfd. mica condenser to antenna lead just inside the receiver

GENERAL MOTORS Chassis "A" Models

Intermittent reception
1) try a new set of tubes, replacing the old ones one at a time
2) go over all connections in set with a hot soldering iron to clear up all bad joints
3) check each r-f by-pass cond. for leakage and intermittent troubles

Whistling, or squealing
1) see Case History listed for this trouble under General Motor Chassis "B" Models

Hum in models bearing serial numbers below 62100A
1) "shorted" metal-encased 0.1-mfd. condenser across first choke in filter

GENERAL MOTORS Chassis "B" Models

Whistling or squealing
1) check all joints and re-solder any that look suspicious
2) make sure all connections to the chassis are O.K.
3) solder a pigtail from the hub of each condenser rotor section to its wiper—also one from the rotor shaft to the chassis frame. The shaft connection should be in the middle section

GENERAL MOTORS "LITTLE GENERAL"

Fading, Intermittent whistling or squealing
1) check all resistors and condensers for change in value, and intermittent "opens" or "shorts"
2) ground the variable condenser rotor with a pigtail

GENERAL MOTORS 50 Series

Weak reception, Plate voltages low
1) leaky or short-circuited r-f plate condenser (usually the top one in the three-pile assembly)

GENERAL MOTORS 110

Tone "mushy"
1) replace the 250,000-ohm detector load resistor

Intermittent fading
1) faulty by-pass condensers in small cans (three to a can) located under the chassis. Replace with individual tubular condensers

GENERAL MOTORS 120, 130, 140, 150, 160

Intermittent drop in volume, (set does not go completely dead)	1)	tighten both top and bottom screws holding stator plates on gang condenser
	2)	solder a wire between top and bottom stator lugs
Weak reception, Inoperative, (serial numbers below *29100A* or *1700B*) (all voltages, condensers and resistors check O.K.)	1)	grid-bias on tubes too high. Connect a 200-ohm, 10-watt resistor across the 240-ohm section of the bias voltage divider in order to decrease the grid-bias on the tubes and bring up the sensitivity of the receiver
"Scratchy" noise	1)	replace the 0.25-mfd. metal-cased by-pass condenser connected to the '27 detector cathode
	2)	replace the volume control
Whistling or squealing, Noisy tuning	1)	corroded condenser-gang rotor contacts. Solder the r-f filament grid return leads directly to chassis and connect flexible pigtail resistors between the rotors and the tuning condenser frame
	2)	reduce screen grid voltage by installing 25,000-ohm bleeder resistor between screen lead of third r-f tube and chassis
Fading, Intermittent reception	1)	open-circuiting 0.01-mfd. audio coupling condenser
	2)	open-circuiting screen by-pass condenser
	3)	broken antenna section of dual volume control
	4)	replace first r-f tube cathode by-pass condenser with a tubular unit
Poor control of volume	1)	replace type '24 tube in r-f stage with '35 tube
Dial readings incorrect	1)	re-align receiver
	2)	re-locate dial scale
Fuse blows	1)	short-circuited or leaky 0.1-mfd. line buffer condensers
Hum, (reception otherwise normal in No. 20 and No. 130 receivers)	1)	replace the 0.1-mfd. condenser located under the a-c terminal strip
		bond the metal cases of the by-pass condensers to the front and rear of the chassis
Hum	1)	short-circuited 0.1-mfd. filter choke "tuning" condenser
	2)	defective type '27 tube
	3)	temporarily "short" out the power fuse mounted on the chassis. If the hum stops, clean fuse clips. Replace fuse
Poor tone quality (in models 120, 130 and 140)	1)	unmatched '45 output tubes
	2)	check the output transformer
	3)	faulty variable resistor in the tone control. Replace with new 500,000-ohm unit

GENERAL MOTORS 170-E (Aircell)

Inoperative, Weak reception (*B* and *C* voltages O.K.)	1)	if *A*-voltage reads "zero" volts when tubes are *in* their sockets, and 2 volts when the tubes are *out* of their sockets, resolder all filament ck't connections

GENERAL MOTORS 211

Weak reception, Distortion	1)	open 250,000-ohm ½-watt detector plate resistor. Replace

GENERAL MOTORS 220

No control of volume	1)	try replacing '27 AVC tube even if it checks O.K. in tube tester

GENERAL MOTORS 251

Cross-modulation on strong signals	1)	switch the lead from the ant. coil to the lug next to the coil, using the old antenna coil lug to connect to the oscillator condenser
	2)	install a well-shielded lead from the antenna post to the antenna coil

GENERAL MOTORS 252, 253, 254, 255, 256, 257, 258

Inoperative,	1)	if removal of the AVC tube restores normal volume, check the 2-meg. carbon resistor in the AVC tube grid circuit
Distortion, Poor tone quality	1)	faulty 100,000-ohm resistor in the output bias system. This, and another resistor in series with it, are shunted across the speaker field to form a voltage divider. Their junction forms the bias potential tap. Replace the 100,000-ohm unit
	2)	unmatched '45 output tubes
	3)	check the output transformer
	4)	faulty variable resistor in the tone control. Replace with 500,000-ohm unit
Intermittent buzz, (stops when aerial and ground are disconnected, but when it is not of an external nature)	1)	faulty type '23 first detector tube (even though it may test O.K.). Replace by substitution tests with a new tube
Excessive hum	1)	faulty power transformer input by-pass condensers, having the center tap grounded. Replace with a pair of 0.003-mfd. units

GENERAL MOTORS (Day-Fan) A-5003, A-5010, A-5091

Distortion, Poor tone quality	1)	unmatched '45 output tubes
	2)	check the output transformer
	3)	faulty variable resistor in the tone control. Replace with new 500,000-ohm unit

GLORITONE

GLORITONE "Aircell" Models

Speaker trouble	1)	magnetic speaker on these sets has dual-coil driving unit designed to operate directly in the plate circuit of the '33 output tubes. These windings develop faults if moisture penetrates into them. Secure a replacement coil, and before installing it, coat it with thin high-grade shellac or insulating varnish and allow to dry thoroughly

GLORITONE 24 (Early)

Hum	1)	check speaker field for "shorted" turns (a continuity test between *yellow* and *red* speaker field leads should show a resistance of 2,500-ohms)
	2)	in the very early models a 0.006-mfd. condenser was connected from the power transformer primary to ground. If this condenser is "open" a hum will result

GLORITONE 26, 26P

Inoperative, Very low volume (model 26)	1)	"open" 2,460-ohm tap on the 5,500-ohm speaker field winding. Can repair by simply connecting a 25,000-ohm resistor from the screen-grid circuit to the field coil. Then it is unnecessary to rewind the field coil
Intermittent reception accompanied by howling or oscillation	1)	open screen-grid or cathode resistor bypass condensers located all in one can beneath the r-f coil shields. Cut off all leads to these condensers, and connect separate 0.25-mfd. units between the r-f cathodes and screens to chassis. A new wire will have to be run direct between cathode terminals on the sockets, and another wire between screen terminals on the sockets
Intermittent reception, (2,640-ohm resistor heats up excessively when set cuts out)	1)	replace the "Candohm" resistor with a carbon-type unit
	2)	short-circuit in speaker field which is tapped to act as a bleeder resistor for the screen-grid voltage supply, causing it to heat. This is usually caused by the wearing of the enameled wire insulation under the lead connection. Repair by placing a heavy piece of paper or empire cloth under this lead and giving the entire coil a coat of dope
Weak reception	1)	change the '45 output tube to a 2A5. The bias resistor should be a 400-ohm 2-watt unit by-passed with a 5-mfd. 35-v. electrolytic condenser
Whistling, Howling noise,	1)	lead from antenna post to volume control shifted from original position. See that it runs from antenna terminal to one corner of the chassis, and from this point to the next corner, and then to the volume control, sliding it under all other wires and making sure that it rests directly on the metal chassis all the way
Loud hum, Weak reception	1)	faulty 8-mfd. electrolytic filter condenser

GLORITONE 27

Inoperative	1)	try shunting a 5,000-ohm resistor across the 8,400-ohm section of the voltage divider. Increase volume by placing r-f plate lead on first lug of voltage divider instead of second
Fading, (switching a light on or off clears trouble) (all parts test O.K.)	1)	solder a flexible pigtail from the rotor of the tuning condenser to the ground
Low volume	1)	defective speaker field; coil open-circuits under load. Test by touching metal screwdriver to core with set in operation and noting magnetism
	2)	to increase sensitivity of receiver, locate the wire on the terminal next to the B-plus end of the Candohm resistor. Solder it to the extreme end so as to increase the plate voltage
Whistling and squealing	1)	connect a 0.5-mfd. condenser from r-f cathodes to ground. Realign receiver
	2)	ground the r-f coil leads direct to chassis instead of to coil cans—insures better grounding contact

(Cont'd)

GLORITONE 27—*(Cont'd)*

"Put-put" (motorboating) sound	1)	see if antenna lead is out of place
Hum	1)	inductive hum originating in audio section can be reduced by inserting a resistance of about 0.5 megohm between the power tube grid and ground

GLORITONE 99

Inoperative at low-frequency end of dial	1)	check for faulty 3,000-ohm resistor, or faulty 0.01-mfd. condenser in 1st detector-oscillator cathode circuit
Distortion at high volume	1)	faulty 4-mfd. electrolytic condenser
	2)	check 400,000-ohm resistor from type '47 grid to voltage divider for change in value or open circuit, causing high pentode plate current
	3)	check type '47 tube. Replace if weak

GLORITONE 99-B

Loud whine developing at high volume and building up till signal is drowned out	1)	vibration of oscillator and tuning condenser plates transmitted from the speaker through the chassis. Float the oscillator and tuning condensers on rubber cushion supports

GOLDENTONE

Case Histories are listed under FORDSON

B. F. GOODRICH

Case Histories are listed under MANTOLA

GOODYEAR-WINGS

See Case History listings under BELMONT

GRAYBAR*

GRAYBAR GB-4

(Uses same chassis as RCA R-5 receiver.) See the Case Histories listed for the RCA R-5 receiver

GRAYBAR GT-7

(Uses same chassis as RCA R-4 receiver.) See the Case Histories listed for the RCA R-4 receiver

GRAYBAR GB-8

(Uses same chassis as RCA R-7 receiver.) See the Case Histories listed for the RCA R-7 receiver

GRAYBAR GT-8

(Uses same chassis as RCA R-8 receiver.) See the Case Histories listed for the RCA R-8 receiver.

GRAYBAR GB-8A

(Uses same chassis as RCA R-7A receiver.) See the Case Histories listed for the RCA R-7A receiver

GRAYBAR GB-9

(Uses same chassis as RCA R-11 receiver.) See the Case Histories listed for the RCA R-11 receiver

* For a Cross-Index of the Model Numbers of Graybar with those of corresponding American G. E., American RCA and RCA-Victor, and American Westinghouse receivers, see the table in *Section 5* of this *Handbook.*

GRAYBAR GC-13

(Uses same chassis as RCA R-6 receiver.) See the Case Histories listed for the RCA R-6 receiver

GRAYBAR GC-14

(Uses same chassis as RCA R-12 receiver.) See the Case Histories listed for the RCA R-12 receiver

GRAYBAR GT8-56

(Uses same chassis as RCA R-71 receiver.) See the Case Histories listed for the RCA R-71 receiver

GRAYBAR GT8-69

(Uses same chassis as RCA R-72 receiver.) See the Case Histories listed for the RCA R-72 receiver

GRAYBAR GT10-69

(Uses same chassis as RCA R-74 receiver.) See the Case Histories listed for the RCA R-74 receiver

GRAYBAR GT10-88

(Uses same chassis as RCA R-76 receiver.) See the Case Histories listed for the RCA R-76 receiver

GRAYBAR GT10-99

(Uses same chassis as RCA R-77 receiver.) See the Case Histories listed for the RCA R-77 receiver

GRAYBAR GB-100

(Uses same chassis as RCA R-55 receiver.) See the Case Histories listed for the RCA R-55 receiver

GRAYBAR GB-310

(Uses same chassis as RCA Radiola 18 receiver.) See the Case Histories listed for the RCA Radiola 18 receiver

GRAYBAR GB-311

(Uses same chassis as RCA Radiola 33 receiver.) See the Case Histories listed for the RCA Radiola 33 receiver

GRAYBAR GB-320

(Uses same chassis as RCA Radiola 51 receiver.) See the Case Histories listed for the RCA Radiola 51 receiver

GRAYBAR GB-330

(Uses same chassis as RCA Radiola 60 receiver.) See the Case Histories listed for the RCA Radiola 60 receiver

GRAYBAR GB-340

(Uses same chassis as RCA Radiola 62 receiver.) See the Case Histories listed for the RCA Radiola 62 receiver

GRAYBAR GB-500

(Uses same chassis as RCA Radiola 44 receiver.) See the Case Histories listed for the RCA Radiola 44 receiver

GRAYBAR GB-550

(Uses same chassis as RCA Radiola 46 receiver.) See the Case Histories listed for the RCA Radiola 46 receiver

GRAYBAR GB-600

(Uses same chassis as RCA Radiola 66 receiver.) See the Case Histories listed for the RCA Radiola 66 receiver

GRAYBAR GB-678

(Uses same chassis as RCA Radiola 48 receiver.) See the Case Histories listed for the RCA Radiola 48 receiver

GRAYBAR GB-700

(Uses same chassis as RCA Radiola 80 receiver.) See the Case Histories listed for the RCA Radiola 80 receiver

GRAYBAR GB-770

(Uses same chassis as RCA Radiola 82 receiver.) See the Case Histories listed for the RCA Radiola 82 receiver

GRAYBAR GB-900

(Uses same chassis as RCA Radiola 86 receiver.) See the Case Histories listed for the RCA Radiola 86 receiver

GRAYBAR GB-989

(Uses same chassis as RCA R-10 receiver.) See the Case Histories listed for the RCA R-10 receiver

---

GREBE

GREBE HS-4

Intermittent reception, Noisy reception, Whistling or squealing	1) 2)	replace 8,500-ohm resistors in screen-feed circuit, using wire-wound 10-watt units remove entire 6-section metal-cased by-pass condenser. Replace the r-f and i-f cathode by-pass units with 0.1-mfd. condensers; the second detector tube by-pass units with 0.5-mfd. by-pass condensers; and the tone control condenser with a 0.02-mfd. unit. The capacity of the screen by-pass condensers is also 0.1-mfd.

GREBE M 3-4

Fading	1)	leaky or intermittently open-circuiting condensers. Test each separately

GREBE SK-4 Synchrophase

Intermittent reception	1)	broken pig-tail leads on gang condenser. Examine especially the first condenser of the gang which is in series with the antenna
	2)	"gassy" type '24 tube. Try several '24 tubes
	3)	intermittent "open" in 0.1-mfd. condenser by-passing 20,000-ohm grid resistor in first r-f stage. The replacement condenser must be grounded to the small coil under the chassis where it connects to first r-f grid coil
Intermittent reception, Fading, Cuts out when "dx" switch is snapped	1) 2) 3) 4)	replace detector grid return by-pass replace 3-meg. series resistor with a 1.5-meg. unit clean contact of "phono" switch (this is operated by the condenser gang when in the high-frequency position "gassy" type '24 tube. Try several new '24 tubes
Low volume	1)	check aligning condenser at extreme right of tuning gang for high-resistance "leak"
Distortion at low volume	1)	changed value of 0.25-meg. resistor from centertap of push-pull input. Replace
60-cycle hum, (filter condensers check O.K.)	1)	faulty 0.1-mfd. condenser mounted at the detector tube. Replace with new unit
*Whistling between 550 and 750 kc	1)	clean the contacts of all wiper fingers on tuning condenser rotor shaft. Tighten the fingers down, without restricting condenser movement. Align

GREBE 6-AC

Inoperative (no plate voltage on detector)	1)	"open" 2,500-ohm detector plate resistor. Also check the det. plate by-pass condenser between the resistor and chassis for a "short"
Inoperative (no plate voltages on tubes)	1)	"open" bias resistor. The '26 bias resistor has a value of 95 ohms while that for the '71A has a value of 695 ohms
Whistling or squealing	1)	any tubes drawing high plate current are "gassy." Try new tubes in these sockets
	2)	faulty 1-mfd. by-pass condenser between ground and the two filament bus bars of the '26 tubes
Motorboating sound	1)	faulty 750-ohm resistor and condenser which form a resistance-capacity filter to prevent motorboating

GREBE 7-AC Synchrophase

Inoperative	1)	"shorted" tuning condenser
	2)	faulty push-pull input transf.
Whistling or squealing	1)	any tubes which draw a high plate current are "gassy." Try several new tubes in these sockets
Motorboating sound	1)	faulty by-pass condensers between the intermediate and detector voltage supply points and ground. These form part of a resistance-capacity filter for eliminating motorboating

GREBE 89

Volume and sensitivity insufficient	1)	substitute a 0.01-mfd. condenser for the 0.00005-mfd. unit located between the antenna and first r-f coil

---

GRIFFITH

GRIFFITH 20

Inoperative, Volume weak	1)	check 40,000-ohm carbon resistor attached to one end of Candohm and wired between plate of '27 first a-f and grid of 47's. Replace with 5-watt unit. Also replace 0.5-mfd. by-pass unit in the condenser block (*red* wire) with external 0.5-mfd. 600-volt unit
Intermittent reception, "Fuzzy" tone	1)	check 0.1-mfd. 600-volt and 0.05-mfd. by-pass condensers

---

GRIMES

GRIMES SERENADER O

Whistling at low frequencies (tubes and voltages test O.K.)	1)	high-impedance r-f coil primary windings. Detune the plate coil in the first r-f stage by connecting a 0.00005-mfd. condenser across it

---

GRUNOW

GRUNOW—(ALL MODELS)

Rumbling at low volume	1)	faulty volume control. On some models, the end plate of the chassis must be removed to solder the a-c leads in place, when replacing the volume-control unit

GRUNOW—ALL 1937 MODELS

Inoperative on broadcast band	1)	broadcast-band oscillator coil "open"
	2)	faulty 6KC r-f tube
Hum	1)	connect frame of large speaker to ground

GRUNOW 4A

Distortion	1)	check for "leaky" coupling condenser connected to grid of 42 tube. (Condenser is lated over power transformer)

GRUNOW 4B

Distortion	1)	replace 0.02-mfd. coupling condenser (*Part No. 29567*)

GRUNOW CHASSIS 5A

Inoperative (no plate voltages)	1)	flashing occurring between the humbucking coil and the speaker winding, destroying the field coil leads. (Although factory diagrams do not show a humbucking coil in the speaker, some of these sets have them)

GRUNOW CHASSIS 5B

Weak reception, Distortion	1)	inspect 25Z5 wafer socket to see if sealing compound from filter condenser can has melted and run between its two layers. Replace socket
Motorboating, Weak reception on local stations only	1)	open-circuited 20-mfd. filter condenser Replace with new unit across the terminals of the old unit on condenser bank
	2)	open-circuited 8-mfd. filter condenser. Repair similar to above *Note*: it may be best to replace the entire bank, since the units on the newer types have better connecting leads
60-cycle Hum	1)	pilot light short-circuiting on variable condenser gang. Twist insulating washer until pilot light is insulated from condenser frame, then apply some cement to hold it in place
	2)	loose laminations in filter choke
	3)	faulty filter choke coil. Replace
Set draws current after being turned off, (dial-light glows dimly)	1)	due to large capacity of the condenser jammed in behind the speaker. Replace with smaller unit
Rattle in loudspeaker	1)	leads from output transformer touch the cone. Move them further back and fasten them to prevent them from returning to the cone

GRUNOW CHASSIS 5E

Motorboating sound, Intermittent reception	1)	check the 0.1-mfd. 400-volt plate filtering condenser (*No. 28726*)

GRUNOW CHASSIS 5G

Distortion	1)	replace "coupling" condenser between '75 tube and '42 tube. Use a good quality high-voltage condenser for replacement

GRUNOW CHASSIS 6A, 6C

"Mushy" reception, Distortion when volume control is advanced toward "maximum," Poor tone	1)	suspect high-resistance leakage in the 0.01-mfd. audio coupling condenser between the plate of the '75 tube and the grid of the '42. Leakage resistance even as high as 5 to 10 megohms is sufficient to impair reception. A neon condenser tester will reveal this trouble, but an ohmmeter will frequently fail to show it unless it has a sufficiently high range. Replace with a 600-volt type unit
Inoperative, Weak	1)	check 0.02-mfd. condenser by-passing plate supply of 6D6 r-f stage for a "short." The 2,000-ohm ¼-watt resistor in plate circuit of same tube will also likely be damaged if this condenser "shorts"
Hum in 6C receiver	1)	"open" 0.075-mfd. condenser connected between ground and junction of the two 250,000-ohm resistors connected to control grid of 42 tube. Use accurate similar capacity value for replacement

GRUNOW CHASSIS 6D

See also Case History listed for Grunow Chassis 6F

Set dead	1)	short-circuited lead in condenser block. This necessitates replacement of entire block, as negative lead is tied inside it
Intermittent reception	1)	faulty type '75 tube (even though it may test O.K.). Replace with new tube
Hum (early models)	1)	install a low-voltage type 12- to 20-mfd. electrolytic by-pass condenser across the 6,000-ohm bias resistor connected to the cathode of the '75 tube (the voltage across this resistor is only 2 or 3 volts)
Motorboating when vol. control is turned to reduced volume	1)	replace 1-mfd. condenser connected to "low" end of volume control (end with *black* unshielded wire) and ground
Distortion (especially on low vol.)	1)	replace 0.02-mfd. condenser connected between plate of 75 tube and control-grid of 42 tube—even if it checks O.K.

GRUNOW CHASSIS 6F

Inoperative, Weak (early models) (receiver voltages low)	1)	under conditions of excessive line voltage, the 8-mfd. 455-volt section of the ***No. 3009-1*** filter condenser becomes "shorted". This shorting is caused by a voltage surge. This surge can be prevented or reduced by connecting an additional "bleeder" resistor in parallel with the condenser. A 40,000-ohm 5-watt carbon resistor (*Part No. 34421*) can be used for this purpose. Connect it across the *black* and *white* leads of the 8-mfd. filter condenser which connects directly across the output of the '80 rectifier

GRUNOW CHASSIS 7A

Inoperative (no screen-grid voltage)	1)	replace the 14,700-ohm section of the Candohm resistor with a 15,000-ohm, 10-watt wire-wound unit
Inoperative, Intermittent reception	1)	faulty 0.1-mfd. condenser in block behind tuning gang. Identify it by a *green* lead which is connected together with two *red* leads to a common terminal at the left rear of the short-wave switch. Replace with a 600-volt unit
	2)	defective 1,000-ohm resistor which is usually ruined as a result of the above condition (located in resistor bank)

(Cont'd)

GRUNOW CHASSIS 7A—(*Cont'd*)

Intermittent drop in volume, Inoperative at high-frequency end of dial, (trouble corrected by shifting band switch from broadcast to short-wave band and back again)	1)	check the two 0.1-mfd. condensers connected between the lower end of the r-f coils and "ground". They are encased in a small can fastened to the bottom of the coil shields. The connections are made by wire leads inside the shield—the lugs on the can are "blanks"
Intermittent reception	1)	too much delay in AVC circuit. Replace all the 0.1-mfd. by-pass condensers in the grid circuits of the type '78 tubes with 0.01-mfd., 600-volt units
Poor tone	1)	leaky electrolytic filter condensers. Replace with new 8-mfd. units, leaving the shield off
	2)	voice coil rubbing. Recenter
Choked and distorted reception	1)	"leaky" 0.25-mfd. condenser in 2nd-detector plate resistance network. This is one of 6 condensers in a block and is identified by a *black* and *yellow* lead which connects to the junction of the two 0.1-megohm resistors. The other end of this condenser "grounds" inside the can.
Hum, Poor tone	1)	faulty type '6B7 tube (even though it may test O.K.). Replace with new tube
Motorboating sound, Blocking	1)	due to the two large square coil shield cans mounted together under the condenser gang working loose. Bond each can to chassis

GRUNOW CHASSIS 7B

Inoperative on broadcast (O.K. on s.w.)	1)	faulty 0.01-mfd. cond. on 6-section band switch—buried under 4th and 5th sections (from front) of switch
Noisy reception on the "A" band, Inoperative	1)	dirty or corroded grounding arms which hold the variable condensers in place. Clean them with fine sandpaper
Dual-ratio drive does not stay in low-ratio position	1)	loosen the two small bolts on the drive-sleeve assembly; push the drive sleeve back slightly, re-tightening the screws as tightly as possible
Microphonic noises	1)	chassis bolts too tight. Loosen bolts
	2)	shafts on chassis touching cabinet
Loss of volume	1)	faulty volume control. Replace

GRUNOW CHASSIS 7C

Inoperative		leakage between pri. and sec. windings of r-f coil

GRUNOW CHASSIS 8A

See also Case Histories listed for Grunow Chassis 7A

Weak (high plate current in output tube), Distorted	1)	"leakage" in filter condensers (through the fibre protective covering to the close-fitting can) causes a low-resistance short condition of the output tube's bias resistor. Check the condensers
	2)	make sure that all filter condensers are insulated from the chassis—remember this also when replacing condensers

(Cont'd over)

GRUNOW CHASSIS 8A—*(Cont'd)*

Inoperative, Intermittent reception	1)	check the by-pass condenser block and voltage divider. The "high" side of the latter should be 17,500 ohms, and the next section from there to ground should be 14,700 ohms. Use 10-watt wire-wound units for replacement

GRUNOW CHASSIS 8B

Inoperative	1)	check for "shorted" 0002-mfd. condenser connected to 42 tube plate. Replace with a 600-volt unit
Volume cannot be reduced on local stations	1)	"open", or short-circuited second-detector cathode by-pass condenser. Replace, if necessary ,with an 8-mfd. 25-v. unit
Fading	1)	check first detector plate by-pass condenser *No. 39*, i-f plate by-pass condenser *No. 38*, and AVC condenser *No. 36* for leakage. Replace if necessary
Distortion	1)	try reducing the value of coupling condenser *No. 29* and 0.01-mfd.
Motorboating sound	1)	"leaky" coupling condenser *No. 27* (between plate of '37 tube and grid of '42 tube) leaking through 0.5-meg. grid resistor of the '42 tube. Replace the grid resistor with a 0.05- or 0.1-meg. unit. Also replace coupling condenser *No. 27*

GRUNOW CHASSIS 8E

Weak reception, Difficult to align properly	1)	set not properly aligned because one or more trimmers unconnected when set left factory. Connect them carefully, and realign
Crackling and popping noises	1)	if noises persist with volume control turned off check for faulty push-pull audio input transformer

GRUNOW CHASSIS 9A

See also Case Histories listed for Grunow Chassis 7A

Fading	1)	if fading occurs when volume control is touched, check the 0.04-mfd. condenser which connects from center tap to ground. Use 0.05-mfd. for replacement

GRUNOW CHASSIS 9C, 9G

Inoperative after being switched from "broadcast band" to "S. W." position and back	1)	faulty 6A7 detector-oscillator tube (trouble will not usually show up in a tube checker). It may be necessary to try several new '6A7's before a suitable one is found
	2)	align the receiver carefully

GRUNOW CHASSIS 11A

See also Case Histories listed for Grunow Chassis 7B

Distortion	1)	check for "leaky" coupling condenser between 85 second detector and 76 push-pull tubes
Whistling or squealing	1)	high-resistance connection between shield and socket of type '6C6 tube. Drill out mounting rivet, replacing it with a 6-32 brass machine screw and nut. Place a soldering lug under this screw on the underside of the chassis, and ground this lug to the chassis
Very short tube life		Install line voltage regulator to reduce line voltage slightly even if normal

GRUNOW 11B

Intermittent reception	1)	antenna coil intermittently "open." Replace

GRUNOW CHASSIS 11G

Inoperative (no voltage, or low voltage on 6K7 i-f screens)	1)	check 0.1-mfd. 200-volt tubular screen by-pass condenser (*Part No. 29,135*) (connected from screen of the first i-f tube to ground) for "shorted" or "leaky" condition. Replace with 0.1-mfd. 600-volt unit

GRUNOW CHASSIS 12A

Weak reception (6A8 plate volt. low)	1)	replace 0.02-mfd. condenser and 2,000-ohm 2-watt series resistor in can adjacent to 6A8 socket
Low volume, Poor tone, Distortion	1)	speakers out of phase—polarity of their terminals reversed. Test by shorting out voice coil in large speaker and reversing the polarity of one of the small speakers. Connect leads of one of the small speakers in the position which gives best response. Then do the same with large speaker, connecting leads in position which gives best output
Noisy reception	1)	check for loose coil-mounting bracket

GRUNOW 12B

Noisy reception, Microphonic, Fading	1)	loose coil mounting bracket
	2)	ground the rivet at "ground" end of output stage bias resistor
	3)	replace 0.05-mfd. cond. by-passing grid ret. of 1st i-f transf. Leave leads loose

GRUNOW 12W

See also Case Histories listed for Grunow 12B

Inoperative	1)	check for "shorted" 0.1-mfd. by-pass condenser connected from third i-f transformer plate return to ground. Also check 2,200-ohm voltage-dropping resistor in series with second i-f tube plate circuit for damage due to overheating

GRUNOW 60

Distortion	1)	a-f coupling condenser "leaky." Replace this condenser regardless of how it checks

GRUNOW CHASSIS 65B, 65C

Same Case Histories as those listed for Grunow Chassis 5B

GRUNOW MODELS 450, 460, 470

Inoperative (no voltages on any tubes)	1)	faulty dual 8-mfd. electrolytic condenser. For replacement, use a high-grade unit having low leakage

GRUNOW CHASSIS 500

See Case Histories listed for Majestic 55

GRUNOW MODEL 501

See Case Histories listed for Grunow Chassis 5B

GRUNOW MODELS 520, 530

Same Case Histories as listed for Grunow Chassis 5B

GRUNOW 542

Inoperative (on short-wave bands only)	1)	set switch to short-wave position. If no signal is obtained when control-grid of 6Q7 tube is touched with finger, replace 0.02-mfd. by-pass cond. from one leg of switch to ground. Use a 600-v. cond.

GRUNOW MODEL 622

Distortion	1)	grid bias on 42 output tube too low. Install 400-ohm 5-watt resistor in series with present wire-wound C-bias resistor for this tube

GRUNOW MODEL 650

See Case Histories listed for Grunow Chassis 6A, 6C

GRUNOW MODELS 660, 661, 662

See Case Histories listed for Grunow Chassis 6A, 6C

GRUNOW MODELS 670, 671

See Case Histories listed for Grunow Chassis 6D

GRUNOW MODELS 690, 691

Same Case Histories as listed for Grunow Chassis 6F

GRUNOW MODEL 700-800 SERIES

"Frying" noises	1)	faulty resistors or condensers
	2)	slight leakage between the windings of the power transformer

GRUNOW MODEL 700

See Case Histories listed for Grunow Chassis 7A, 8A, 9A

GRUNOW MODEL 701

See also Case Histories listed for Grunow Chassis 7A, 8A, 9A

Interference from airport signals	1)	insert the primary or secondary winding (shunted by its trimmer) of a 262 kc. i-f transformer in series with the antenna circuit. Adjust the trimmer until the interfering signal is trapped out
	2)	another method is to realign the i-f amplifier at a new frequency (say 255 or 270 kc). This calls for complete realignment of the r-f and oscillator systems

GRUNOW 720

Inoperative (all tubes & voltages O.K.)	1)	partially "open" secondary in the last i-f transformer
Weak, Distortion	1)	replace "leaky" screen by-pass condenser on the audio amplifier tube

GRUNOW MODELS 750, 751

Same Case Histories as those listed for Grunow Chassis 7B

GRUNOW MODEL 752

No reception over part of Band C even though set checks O.K.	1)	oscillator does not function over this portion of band. Replace 50,000-ohm oscillator grid resistor with unit of higher value—about 150,000-ohms

GRUNOW MODEL 801

Same Case Histories as those listed for Grunow Chassis 7A, 8A, 9A, and for Grunow Model 701

GRUNOW MODEL 821

Same Case Histories as those listed for Grunow Chassis 8B

GRUNOW MODEL 871

See also Case Histories listed for Grunow Chassis 8E

Audio howl	1)	poorly soldered connections—especially in tone control. Resolder every connection in circuits between transformer secondary, push-pull 6F6 tubes and tone control

GRUNOW MODEL 901

Same Case Histories as those listed for Grunow Chassis 7A, 8A, 9A, and for Grunow Models 701 and 902

GRUNOW MODEL 902

See also Case Histories listed for Grunow Chassis 7A, 8A and 9A

Aligning the receiver	1)	this receiver employs a 6B7 tube in an unorthodox AVC circuit. Special manulacturer's instructions must be followed in order to correctly align the set. In adjusting the AVC trimmer on the underside of the chassis, located between the two pairs of i-f trimmers, the correct adjustment in between the two peaks obtained on the output meter when the AVC trimmer is turned counter-clockwise from the maximum

GRUNOW 1067 "Teledial"

Cuts off	1)	check for "open" resistor connected from 6F6 tubes to ground
Motorboating sound on strong signals	1)	check for "shorted" resistor from 6F6 tubes to ground

GRUNOW MODEL 1101

No control of volume	1)	replace remote control cable
	2)	short-circuit between blue wire and metallic shield over black wire

GRUNOW MODELS 1151, 1152

Same Case Histories as those listed for Grunow Chassis 11A

GRUNOW MODEL 1191

Inoperative, ("tuning eye" still functions properly)	1)	check the 205-ohm bias resistor for the 6F6 tube for intermittent "opens". Replace with a 10-watt unit
Fading, Weak	2)	check the 68,000-ohm plate resistor of the 6C5 audio tube for "opens"
Low volume, (volume control ineffective except in extreme "off" position)	1)	oil from the shaft has probably leaked on to the resistance element, causing a high-resistance "leak" in the control
High-pitched tone	1)	check speaker terminal strip for break in lead from output transformer
Tuning indicator tube has short life	1)	connect a 50,000-ohm, 0.5-watt resistor in series with the plate circuit of this tube

GRUNOW MODEL 1241

Same Case Histories as those listed for Grunow Chassis 12A

GRUNOW MODEL 1291

Low volume, (volume control ineffective except in extreme "off" position)	1)	oil from the shaft has probably leaked on to the resistance element, causing a high-resistance "leak" in the control
Inoperative ("tuning eye" still functions properly)	1)	check the 205-ohm cathode bias resistor for the 6F6 tube for intermittent "opens." Replace with 10-watt unit
High-pitched tone	1)	check speaker terminal strip for break in lead from output transformer

(Cont'd over)

GRUNOW MODEL 1291—*(Cont'd)*

Whistling, Motorboating sound	1)	intermittent trouble of this kind may be due to an "open" 6J7 tube screen by-pass condenser. Replace with a 0.1-mfd., 400-volt unit
Inoperative over a part of the dial	1)	one lug of volume control being "shorted" by dial
Microphonic	1)	rubber cushion support for condenser gang loose. Drill out rivets and replace by machine screws

GRUNOW 1541

Inoperative, Intermittent reception	1)	check the 2,000-ohm resistor located in plate circuit of 6K7 AFC amplifier, and the one in plate circuit of 6K7 second i-f tube
Inoperative (only strong locals come in)	1)	check acoustic filter choke in plate circuit of 6R7 tube for "open"

GULBRANSEN

See also Case History listings under Wells-Gardner

GULBRANSEN "CHAMPION JUNIOR"

Inoperative	1)	double open-circuit caused by the corrosion of the primary leads of the first audio transformer, inside the case. Remove the transformer from the case and after removing tape, etc., from the connected joints, clean off the corrosion and solder a new section of the wire to the leads. Re-tape and insulate the newly soldered joints carefully
"Sluggish," Poor tone, Lack of sensitivity	1)	voltage-dropping resistors off value. Check their resistance, replacing with new units if they are found to be above or below tolerance value

GULBRANSEN 8 TUBE A-C CHASSIS

Noisy reception, Intermittent reception	1)	defective type '24 r-f tubes (even though they may test O.K.). Replace with new tubes
	2)	intermittently short-circuiting 0.3-mfd. r-f plate supply by-pass condenser (one of 3 units in a common can). Replace with a new unit

GULBRANSEN 9

Fading	1)	faulty "local-distance" switch. While receiver is operating O.K., jerk the wires leading to this switch. If this causes fading to occur, replace the switch
Whistling or squealing	1)	clean the contacts between the rotor of the tuning condenser and the metal chassis

GULBRANSEN 23

Weak reception	1)	check 40,000-ohm *yellow* carbon resistor mounted on one end of Candohm and wired between plate of '27 first a-f tube and grid of 47's. Replace with 5-watt unit. Also replace 0.5-mfd by-pass unit in the condenser block (*red* wire) with an external 0.5-mfd. 600-volt unit
Intermittent reception "Fuzzy" tone	1)	check 0.1-mfd. (600-volt) and 0.05-mfd. by-pass condensers

GULBRANSEN 40, 40A

Erratic tuning meter action	1)	try new '35 first r-f and i-f tubes
"Plopping" on stations	1)	check value of AVC plate resistor. Replace if value has increased appreciably

GULBRANSEN 75

Noisy, sounding like "static" (on all stations)	1)	if all tubes and voltages check O.K., check the choke coil in the plate circuit of the '24 detector tube

GULBRANSEN 92, 93

Tubes burn out frequently, for no apparent reason	1)	note the position of the *B*-limiting resistor connected from the socket of the '33 tube to the filament prong of the second detector. Arcing often occurs between this resistor and a nearby filament wire (easily visible in dark room)

GULBRANSEN 161

Weak, Noisy	1)	0.006-mfd. coupling condenser from plate of '27 detector tube "leaky". Replace with high-quality 0.01-mfd. unit

GULBRANSEN 200, 291, 292, 295

Fading, Weak reception	1)	poor contacts at the power transformer coil lead lugs which are riveted to posts on terminal plate. Solder each lug to its post

GULBRANSEN 322

Weak	1)	leads to tuning meter coil snapped, thus cutting off the voltage from the associated tube. Replace tuning meter with one of same type (full-scale deflection at 5 mils)
'82 rectifier tube "flashes"	1)	replace the wet 8-mfd. 500-volt electrolytic condenser in the inverted can. Also replace the 0.25-mfd. tubular condenser connected from the positive terminal of the wet condenser. Replace the '82 rectifier tube if a tube tester shows it to have been damaged in any way

GULBRANSEN 872

Distortion	1)	check for "leaky" *C-7* connected in plate circuit of second detector (from junction of resistors *R-5* and *R-6* to ground)

GULBRANSEN 9950

Same Case History as that listed for Gulbransen 200 receiver

HALLICRAFTERS

HALLICRAFTERS 5T Sky Buddy (Early Model)

Receiver drifts off station	1)	check for rapidly changing value in 25,000-ohm screen-dropping resistor for the 6A7 (osc.-1st det.) and 6F7 (i-f and B.F.O.). Replace with 25,000-ohm 5-watt resistor

HALLICRAFTERS H-8 (EC8), H8PA

Inoperative	1)	check tubes
	2)	check coils and i-f transformers for voltages and "grounds"
Weak (all bands)	1)	check antenna
	2)	check i-f stages
	3)	check tubes
	4)	check voltages
Weak (one band only)	1)	check contact points of waveband switch
	2)	check wiring to coils, and the coils, for continuity.
Weak audio	1)	check AVC circuit
	2)	check '42 tube
	3)	check output transformer
	4)	check loudspeaker
Hum	1)	check for grounded filament
	2)	check filter condensers
	3)	check tubes

HALLICRAFTERS S8A

Distortion	1)	check for "leaky" 0.1-mfd. condenser connected from 75 tube plate supply circuit to ground

HALLICRAFTERS SX-9

Blocking on strong short-wave stations	1)	replace ½-megohm AVC resistor with a ¼-megohm unit

HALLICRAFTERS SX-16, SX-17 Super Skyriders

Oscillator frequency "drift" while warming up	1)	replace bakelite molded fixed trimmer condensers connected across oscillator coils—using new silvered mica type units for replacement

---

HALSON

HALSON AC-DC

Receiver stops playing if pilot lights burn out	1)	shunt a 25-ohm resistor across the pilot light socket and replace the bulb with a 6-8 volt pilot. The receiver will now continue to play even though the pilots burn out

HALSON 05

Weak reception	1)	check for shorted, or partially shorted, volume control

HALSON AW6

Hum	1)	"short" between Candohm resistor element and frame. Insulate frame from chassis

HALSON L-10

Hum	1)	faulty volume control. Replace it

HALSON N. S. 40

25Z5 tube and pilot light burned out and socket fused	1)	replace the 25Z5 socket which has fused to "ground"
	2)	replace the 25Z5 tube
	3)	replace 2.5-volt pilot light

HALSON 5LR, 50R, 60M

Inoperative, Distortion, Hum	1)	faulty filter condenser at input to filter

HALSON 515 SW

Poor reception	1)	increase in values of bleeder resistors
	2)	faulty 900-ohm bias resistor for the '45 tube. Replace with a 10-watt unit
Intermittent hum	1)	replace the filter condensers

HAMMARLUND

HAMMARLUND "PRO", "COMET"

Failure of the i-f oscillator	1)	high-resistance connection to one of the secondary lugs on the i-f oscillator coil. Resolder the connection
Insufficient gain	1)	reduce the first-detector cathode resistor to about 2500 ohms. Take the screen voltage directly off the high-voltage *B*-line, with a 1-megohm resistor in series. Replace the cathode resistor in the second-detector circuit with a 5000-ohm fixed resistor and a 10,000-ohm volume control. Mount the latter on the front panel. The screen voltage for the second detector tube should be obtained from the high-voltage line through a 2-megohm resistor in series

HAMMARLUND HQ-120X (Crystal)

Inoperative in "Phasing" position, O.K. with crystal out	1)	crystal phasing switch not making good contact. Clean and adjust contacts
	2)	check for cracked crystal

HOWARD

HOWARD 1936 A.C.-D.C. MODELS

Hum	1)	interaction between the pilot light leads (running from sockets to the resistor) and other nearby wires. Isolate these leads from all the rest of the receiver circuits

HOWARD 1938-39 Models

Inoperative on phono (radio reception O.K.)	1)	"shorted" terminals riveted on rear of chassis

HOWARD "Highwayman" Auto Radio

Fuse blows frequently	1)	see that insulating sleeve is in proper position over fuse
	2)	if sleeve is O.K., replace the vibrator. Do not attempt to adjust the old vibrator points
Inoperative	1)	"open" 0.01-mfd. input grid-coupling condenser to 42 power tube. Replace with 400-volt unit
No control of tone	1)	check for faulty tone control switch. Replace

HOWARD SG-B

Whistling or squealing	1)	dirty or corroded contact springs on the tuning condenser rotors. Solder flexible pigtails from the rotors to the ground, and also clean the contacts

HOWARD W

83V rectifier tubes blow (set plays O.K.)	1)	due to causes which would result in the "B" current drain of the tubes in the receiver to exceed the rating of the 83V
	2)	check 2A5 tube for leakage
	3)	if '56 rectifier tube is "slow-heating" replace it with a faster heating tube
	4)	faulty units in bias circuits

HOWARD X-2, X-3, Y-3

Noise suppressor system does not function	1)	reduce length of the antenna

HOWARD HA-6 (Series 1) Auto Radio

(Serial Numbers Below 2000)

Inoperative	1)	fuse blown. Check it
	2)	"off-on" switch "faulty". Check it
	3)	vibrator "faulty". Test by checking "*B*" voltage
	4)	condenser in power unit "shorted". Test by checking "*B*" voltage
	5)	choke or speaker field coil winding "open". Test by checking "*B*" voltage
	6)	voice coil or speaker transformer "open"
Weak reception, Insensitive	1)	antenna system poor. Check it
	2)	receiver needs aligning. Check alignment (465 kc i-f)
	3)	speaker field coil "shorted". Check it
	4)	2nd i-f transformer *No. 8532* has lost its gain due to softening of the wax and the shifting of the iron-core coupling. If this transformer does not respond to alignment, replace it with new type i-f transf. *No. 8542*. When replacing this unit, readjust the trimmers to 465 kc. When making the adjustment on this unit, and likewise when re-trimming the 1st i-f stage, be sure not to screw the plates down together too tightly as this may bend them permanently out of shape, and they will not spring back when the screw is turned in the other direction. In this event, "peaking" of the trimmers would not be obtained, and the unit would have to be replaced
Insufficient selectivity	1)	check alignment, especially that of the i-f stages
Excessive ignition interference	1)	in Ford 1936 V-8, and other automobiles where an excessive amount of ignition noise is present, the shield bracket should be used with the new type of tuning cable shield plate *No. 8132*. This shield plate is supplied by the set manufacturer together with a screw used to fasten it over the tuning cable opening in the receiver cabinet. This bracket and shield need not be ordered for serial numbers above 5000 (Series 2)
	2)	bond all flexible control cables
Vibrator "hash"	1)	see that cover on power unit makes good contact to the box. Tighten the cover by bending the flanges inward slightly
	2)	check the 0.005-mfd., 1600-volt condenser across the vibrator for "open"
Tone quality poor	1)	check all receiver voltages
	2)	check tubes
	3)	check vibrator
	4)	check 0.02-mfd. condenser in the plate circuit of the '75 tube for "open" circuit
	5)	speaker cone "off center". Adjust cone, or change speaker if necessary

(Cont'd)

HOWARD HA-6 (Series 1) Auto Radio—(*Cont'd*)

(Serial Numbers Below 2000)

Whistling or squealing	1)	"open" 0.1-mfd., 400-volt by-pass condenser *C6* in the *B* circuit
	2)	grid lead between the 6L7 mixer tube and the variable condenser may be too close to the *Ant.* section of the variable condenser (top section). Push this lead away
Audio whistle or howl	1)	"open" 0.006-mfd. condenser in plate circuit of '42 tube
	2)	variable tuning condenser not floating freely in its rubber mountings. "Free" the condenser
Tuning dial "off" calibration	1)	receiver not properly aligned. Check the alignment
	2)	dial hand not set to *maximum* line when tuning condenser is at full-capacity position. Reset the screw on the back of the drive head
Volume control shaft slips	1)	cable may not be meshed with slot in control shaft due to cable not being far enough in the coupling
	2)	volume control bracket may be bending back at an angle which does not allow the control to meet the shaft slot

HOWARD HA-6 (Series 2) Auto Radio

(Serial Numbers Above 5000)

Inoperative	1)	fuse blown. Check it
	2)	"off-on" switch "faulty". Check it
	3)	vibrator "faulty". Test by checking "*B*"" voltage
	4)	condenser in power unit "shorted." Test by checking "*B*" voltage
	5)	choke or speaker field coil winding "open". Test by checking "*B*" voltage
	6)	voice coil or speaker transformer "open"
Weak reception, Insensitive	1)	antenna system poor. Check it
	2)	receiver needs aligning. Check alignment (465 kc i-f). Inability to peak an i-f transformer may be due to absence of trimmer capacity variation, even though the trimmer screw turns. This occurs when the i-f trimmer is turned too tight, causing the plate to become permanently "sprung"
	3)	speaker field coil "shorted"
Insufficient selectivity	1)	check alignment, especially that of the i-f stages
Vibrator "hash," Noisy	1)	make sure that the cover on the power unit makes good contact to the box. Tighten the cover by bending the flanges inward slightly
	2)	check the 0.005-mfd. 1600-volt condenser across the vibrator for "open"
	3)	make sure that the chassis and power unit make good contact to the inside of the receiver case
	4)	make sure that the paint has been removed from under the heads of the various bolts on the outside of the case—bolts that hold the power unit
	5)	harmonics of the i-f may be noticed when the chassis is being serviced outside of the receiver case. This is a normal condition and will not be present when the receiver is in actual use
	6)	make sure to bond all the flexible control cables

(Cont'd)

HOWARD HA-6 (Series 2) Auto Radio—(*Cont'd*)

(Serial Numbers Above 5000)

Tone quality poor	1)	check all receiver voltages
	2)	check tubes
	3)	check vibrator
	4)	check 0.02-mfd. condenser in the plate circuit of the '75 tube for "open"
	5)	speaker cone "off-center." Adjust cone, or change speaker if necessary
Whistling or squealing	1)	"open" 0.1-mfd., 400-volt by-pass condenser *C6* in the *B* circuit
	2)	grid lead between the 6L6 mixer tube and the variable tuning condenser may be too close to the *Ant.* section of the tuning condenser (top section). Push this lead away
Audio whistle or howl	1)	"open" 0.006-mfd. condenser in plate circuit of 6B5 tube
	2)	variable tuning condenser not floating freely in its rubber mountings
Tuning dial "off" calibration	1)	receiver not properly aligned. Check the alignment
	2)	dial hand not set to *maximum* line when tuning condenser is at full-capacity position. Reset the screw on the back of the drive head
Volume control cannot be adjusted to minimum vol.	1)	wrong assembly of the drive cable. Before connecting the drive cable, turn the volume control shaft in the receiver all the way to the *left*, and the control knob on the head all the way to the *right*

HOWARD E-14

Hum	1)	insert a 30-henry choke between the speaker cable and the field coil terminal, adding a 16-mfd. condenser to the input of this choke. *Note*: since there is no room on the chassis for this installation, it will be necessary to install a little shelf in the cabinet above the power transformer, for mounting the units

HOWARD 67

Weak, Tone quality poor	1)	high-resistance leakage in the 0.25-mfd. condenser by-passing the 6F5G plate resistor to ground
	2)	check for "short" or "leakage" between *positive* leads of filter condenser — thus "shorting" speaker field

HOWARD 77

Weak reception	1)	check for "short" or "leakage" between *positive* leads of filter condenser — thus "shorting" speaker field

HOWARD 200

Inoperative	1)	check for "shorted" 0.1-mfd. 200-volt condenser from 6K7 screen to chassis

HOWARD 400X, 425

Pushbuttons noisy	1)	open pushbutton box and clean contacts

HOWARD 518 Series

Hum	1)	add an 8-mfd. 450-volt filter condenser across input of filter

---

HUDSON MOTOR CAR CO.

HUDSON-ESSEX (RCA) DB-37 Auto Radio

Inoperative, Weak volume	1)	turn the volume control up suddenly to see if receiver motorboats with volume control wide open. Check to see if a large voltage exists at one diode plate. If so, there is a "short" in the second i-f transformer caused by bare plate-return lead rubbing against secondary winding. Cover bare leads with spaghetti
Broken wire	1)	broken short wire connected from gang condenser to the AVC by-pass condensers returning from the antenna coil and first-detector r-f coupling coil. Replace with a short flexible pigtail lead. The condensers are the small, *black* bakelite-encased units located between the bases of the 6D6 and 6A7 tubes

HUDSON (STEWART-WARNER) DB-40, SA-40 Auto Radios

Low sensitivity (tubes and parts all O.K.)	1)	check setting of antenna trimmer. If receiver has been aligned using any dummy antenna other than the 80-mmfd. condenser recommended by the manufacturer, the setting of this trimmer will be off considerably
	2)	misalignment of i-f transformers when the upper and lower units are aligned at different times, since one i-f trimmer is on the "control" unit and the balance are in the "lower" unit. Align *both* units of the receiver
Hum	1)	check for "ground" inside of lower end of volume control in the control head (in addition to the ground which is made in the lower radio unit). Remove this accidental ground in the control head
Ignition noise	1)	install additional bonnet (hood) grounding strips. Best location for these can be determined by grounding hood to the body at various points with a knife. If grounding strip is located at a point 10½ inches from center of car, install additional strip 23½ inches from center
Interference with movement of tuning control and dial	1)	dress leads from on-off switch (and all other leads in vicinity of the A filter assembly) so they do not interfere with free motion of the dial cord or the condenser-drive gear sector
Binding in tuning control	1)	check for excessive friction and binding between sector and pinion gears. Reduce it by changing position of pinion gears so that setscrew points upward when condenser plates are fully meshed

---

INTERNATIONAL INDUSTRIES ("KADETTE")

KADETTE 2-TUBE RECEIVER

Inoperative	1)	open-circuited 3,000-ohm resistor located under the type '12A7 tube

KADETTE 4-TUBE RECEIVER

Inoperative, Weak, Distortion	1)	replace the double 5-mfd. by-pass electrolytic condenser across the cathode resistors of the '36 and '38 tubes
	2)	since the heat produced by the series filament resistor (located at the back beneath the chassis) shortens the life of the foregoing condenser, it is a good idea to cut this resistor out and install a standard line cord with self-contained resistor (type made for 4-tube sets)

KADETTE 5-TUBE (BATTERY OPERATED) RECEIVER

Intermittent reception	1)	broken wires in the first i-f transformer—usually broken where they are exposed at the point where they come out to connect to the terminals, above the chassis
Howling when volume control is turned up	1)	change the 250,000-ohm resistor in the grid-return circuit of the 1A6 tube to one of 750,000 ohms (this resistor is across the padding condenser)

KADETTE B

Intermittent reception	1)	replace type '6B7 tube

KADETTE "INTERNATIONAL"

Inoperative (all voltages normal)	1)	insulating washers between gang condenser and chassis slipped out, allowing condenser to "ground" to chassis. Loosen the screws, reset the washers in position, tighten screws
Inoperative, (no plate and screen-grid voltage on all tubes)	1) 2)	faulty 75-ohm resistor in the plate lead of the type 'KR-1 rectifier tube. Replace with a 10-watt wire-wound unit faulty type 'KR-1 rectifier tube
Squealing at the high-frequency end of the tuning dial	1)	short projecting wire from the control grid of the type '36 tube situated too close to the r-f coil. Remove the wire from the coil and re-align circuits
Weak reception, Low volume, Distortion	1) 2) 3)	faulty 0.05-mfd. condenser connected between the plate of the rectifier tube and one leg of the line. Replace faulty filter condensers. Replace with 4-mfd., 175-volt units faulty cathode by-pass condenser. Replace with a 5-mfd., 35-volt unit
Weak reception, Distortion (Early model bakelite case)	1)	in the model using one '39 one '36 and one '38 tube (1-1 v), check the 5-5-25 mfd. electrolytic cathode by-pass condenser for "open"
Hissing, Intermittent whistling at high-freq. end of dial	1) 2)	clean condenser plates and adjust trimmers connect a small r-f choke between rectifier cathode and filter choke
Distortion	1)	if the distortion is evident most on a deeply modulated carrier and when listening to a strong local station, change the detector bias resistance from 100,000 ohms to 50,000 ohms
Hum	1) 2)	faulty 4-4 mfd. 200-volt filter condensers loose connection to frame of tuning condenser (which is insulated from chassis)
Smoking	1)	heater-cathode "short" in 1-v causing 100-ohm protective resistor to 1-v plate to overheat
Speaker rattle	1) 2) 3)	incorrect adjustment loose solder on driving pin loose reinforcement at cone base
Common trouble	1)	heat generated by line dropping-resistor inside receiver causes disintegration of parts—usually the dual 0.5-0.5 mfd. by-pass condenser to 36 and 38 tube cathodes. Replace these—also, remove line-dropping resistor from receiver and replace with a 290-ohm line resistor cord

INTERNATIONAL "J"

Hum	1)	faulty resistor connected to plate of second detector '24 tube and in series with 60,000-ohm resistor to screen of '35 r-f tube. Replace this resistor with one of 500,000-ohm value if necessary

INTERNATIONAL "JS"

Intermittent reception	1)	remove ground wire. If volume increases, it indicates that the by-pass condenser between the plate of the '47 tube and one terminal of the tone control is "leaky." Replace with 0.06-mfd.

INTERNATIONAL ES-19, ES-20, ES-30

Inoperative	1) 2) 3)	"shorted" 0.05-mfd. tone control by-pass burnt-out 50,000-ohm tone control as a result of the above condition. Replace "shorted" electrolytic cond. block

INTERNATIONAL 36

Weak reception	1)	"leaky" 0.02-mfd. 400 volt coupling cond. between the 75 plate and 41 grid

INTERNATIONAL 72

Oscillation, Microphonic howl	1) 2)	separate the '106 and '34 control grid leads faulty type '25S tube (even though it may test O.K.). Replace

INTERNATIONAL 634, 635

Code interference	1)	present wave trap unable to stop code interference. Disconnect it entirely and connect its coil in series with *red* wire running from band switch to antenna coil. Connect its trimmer directly across trap coil. Set for minimum code interference

INTERNATIONAL 1019, 1024

Poor tone, Warm-up time too long	1)	check condenser pack for leakage to chassis

INTERNATIONAL 1200, 2200

Distortion when strong locals are being received, Several images on high end of band	1)	insert a 0.0001-mfd. condenser between the grid of the first detector and the condenser gang. Connect a 2-megohm resistor from grid to ground, and 1 megohm from grid back to the i-f transformer side of the second detector load resistor
Intermittent reception	1)	check condenser between diode load and "high" side of volume control, or between 6C5 plate and 6F6 grid, for "open"

INTERNATIONAL 3734

Same Case Histories as listed for International 634

JACKSON BELL

See also the Case History listings under "Peter Pan"

JACKSON-BELL "PETER PAN"

Inoperative	1)	inspect the soldered joints on the coils under the tape. They often corrode

JACKSON-BELL 34

Distortion	1)	replace the 0.1-mfd. by-pass condenser connected from the screen of the 6J7 tube to ground

JACKSON-BELL 50

Inoperative, Distortion	1)	check the two 0.5-meg. resistors connected in series across the speaker field. These often "open"

JACKSON-BELL 62

Inoperative, Weak (all voltages at tube sockets normal)	1)	check the resistance of the plate coupling coils on top of the r-f coil assemblies. They should be approximately 20 ohms. If the resistance of any one coil is much lower than the others, look for a "short" between the lead to the inner end of the winding, and the balance of the winding. To clear up such a short, unwind the coil carefully, lay a strip of paper over the inner lead and wind the coil back in place again
Receiver overheats	1)	drill several ½-inch holes in the bottom of the cabinet to let air circulate around the power transformer and the rest of the chassis

JACKSON-BELL 79

Hum	1)	check the 8-mfd. electrolytic filter condensers. Replace if necessary

JACKSON-BELL 260

Inoperative (grid bias on type '45 tube approximately 75-volts)	1)	replace the 0.02-mfd. audio coupling condenser (*C-12*)
	2)	replace the 2-megohm grid resistor (*R6*) for the '45 tube
	3)	leaky 0.1-mfd. r-f cathode by-pass condenser. Replace with new unit

KADETTE

(See listings under INTERNATIONAL INDUSTRIES)

KARADIO

KARADIO

No local reception	1)	partially short-circuited 100,000-ohm a-f coupling condenser connected between the plate of the type '85 tube and the first a-f transformer. Replace with new unit
	2)	faulty oscillator, usually a result of a defective type '36 tube. Replace tube

KELLOGG

KELLOGG 523, 526

Hum (when tuned to stations)	1)	install a 0.01- (or 0.02-) mfd., 600-volt condenser from the high-voltage terminal of the '80 rectifier tube socket to ground. Try *each* of the high-voltage terminals of the rectifier socket in turn—use the one which gives best results

KELLOGG 533, 534, 536

Volume dies down suddenly (or slowly), returning to normal with a sharp "click"	1)	check the small "blocking" condensers mounted on the variable condenser gang (these act as "blocking" condensers, not tuning "trimmers"). If faulty, replace with new units of the same values
	2)	check 0.1-meg. resistors in grid-return circuits of the first and second r-f stages. Also check the 5-meg. resistor in detector grid circuit

KENNEDY

KENNEDY 4 A.C.-D.C.

Intermittent reception, Noisy reception	1)	check tube socket connections. Loose connection in one of the tube plate circuits or in the socket of the 6B7 tube is common
Audio howl	1)	check tubes for microphonics
	2)	see if one connection of the volume control is touching the speaker frame, either intermittently or at the frequency of the howl. Bend it away
Hum ripple (when receiver is operated from 25-cycle line)	1)	use a line-voltage regulator, and set it on the lowest voltage tap provided
Unbalanced	1)	set should always be balanced while in its metal case. Drill a small hole in the metal case just over the balancing screw in condenser gang, to make this possible

KENNEDY 10

Hum	1)	if all tubes and parts check O.K., remove lead between the first filter condenser and the high-potential end of the voltage divider. Connect it to junction of choke and speaker field. By-pass the voltage divider with a 1-mfd. 300-volt condenser

KENNEDY 20, 20B

See also Case History listed for Kennedy 10 receiver

Weak reception, Distortion	1)	if plate voltage on 445 push-pull tubes is below 300 volts, check 755-ohm section at one end of voltage divider for "open." Replace this section with a 750-ohm 10-watt wire-wound resistor
Fading (at long intervals)	1)	check tubes
	2)	go over all connections with hot soldering iron
Fading (hum appears when signal fades out)	1)	poor connection in the filament lug connector on the power transformer. Resolder all transformer lug connections
Whistling over entire dial	1)	faulty by-pass in the detector plate output filter
Whistling at only a few points on the dial	1)	test all by-pass condenser units
	2)	if none are faulty, wind a few turns of bare copper wire around the flexible control-grid lead of the second r-f tube, terminating one end of this wire just inside the coil shield
	3)	another remedy is to lower the screen voltages by unsoldering the screen voltage supply lead and resoldering it to the unused tap next to the original tap on the divider

KENNEDY 26

Inoperative	1)	"shorted" compensating condenser on condenser gang
Noisy, Intermittent reception	1)	"shorting" compensating condenser on condenser gang

KENNEDY 30

Fading, Intermittent reception	1)	short-circuiting or leaky detector plate by-pass condensers
	2)	open-circuiting or open-circuited 0.06-mfd. audio coupling condenser
	3)	open-circuiting speaker voice coil

KENNEDY 30-B

Same Case History as listed for Kennedy 10 receiver

KENNEDY 32

Same Case Histories as listed for Kennedy 30 receiver

KENNEDY 42-B

Volume builds up gradually, ends in sudden "plop," then operates normally for short period.	1) 2)	check 0.1-mfd. r-f cathode by-pass condenser check 0.25-mfd. screen bypass condenser

KENNEDY 52

Low volume, Distortion	1)	if '47 output tube plate voltage is low, check the coupling condenser from detector plate to '47 control grid for "open". Use a 0.006-mfd. unit for replacement
Microphonics	1) 2)	check all tubes for microphonics run the speaker leads in grounded shielding braid to prevent them from picking up r-f currents

KENNEDY 60

Intermittent reception	1)	green lead to stator of first tuning cond. broken (replace with flexible wire)
Fading	1)	corroded contacts or insufficient blade tension of waveband switch in short-wave converter

KENNEDY 62

Distortion	1)	short-circuit between the primary and secondary windings of the push-pull input transformer. Replace
Intermittent reception Inoperative (when tuning control is reached or moved from one side of receiver to other)	1)	replace the stator connecting leads with more flexible wires. The present ones open-circuit, since they are not flexible and cannot stand being twisted, when the condenser is rocked

KENNEDY 62A

Same Case Histories as those listed for Kennedy 60

KENNEDY 62-D Chassis

Tuning meter action jumpy, and receiver operation erratic	1)	intermittently "open" 4200-ohm section of Candohm voltage divider resistor. This may check O.K. when switch is off

KENNEDY 63A

Dial light continues to burn dimly when switch is off.	1)	check for "shorted" 0.01-mfd. condenser from one side of on-off switch to ground

KENNEDY 526

Same Case Histories as those listed for Kennedy 26

KENNEDY 632

Same Case Histories as those listed for Kennedy 30, 32

KENNEDY 670 Auto Radio

Only 2 or 3 stations can be tuned in, Tuning very broad	1)	"open" in second i-f transformer secondary which feeds diode plates of the second detector. (Obtain i-f replacement transf. from Belmont Radio Corp., Chicago

KENNEDY 882-62-D

Same Case History as that listed for Kennedy 62-D Chassis

KING

KING 94

Inoperative	1)	check the three tubular r-f plate bypass condensers for "leakage" or "shorts". There is one of these condensers adjacent to each r-f coil
Distortion	1)	check for "open" choke between grid and ground of first r-f tube (this choke provides grid-bias voltage for this tube)

KING 98

Distortion	1)	check for "open" choke between grid and ground of first r-f tube (this choke provides grid-bias voltage for this tube)

KING 2018

(Made by Williams Piano Co., Oshawa, Canada)

Distortion, Hum, "Fuzzy" tone	1)	"open" filter condenser sections. When "open" section is located by condenser test, or by "substitution" with a 8-mfd. electrolytic condenser, leave the old block as it is and use single or dual 8-mfd. electrolytic units connected externally. Increased filter capacity improves the performance

---

KNIGHT

KNIGHT S. G. 8

Same Case Histories as those listed for Columbia Screen Grid 8

KNIGHT B-10563

Noise (disappears when receiver is removed from cabinet)	1)	dial escutcheon rubbing against tinfoil-inlaid paper dial. Solder a grounding wire between chassis and brass escutcheon in cabinet

---

KOLSTER BRANDES

KOLSTER "INTERNATIONAL"

Fading	1)	"shorting" of resistor (located near volume control) to one of the control terminals

KOLSTER-COLUMBIA C2, C4

Intermittent "frying" noises accompanied by decrease in volume	1)	breakdown of insulation between the primary and secondary windings of one or more r-f coils, allowing plate current to leak into grid circuit. Check all coils

KOLSTER "K" Series Receivers

Weak reception	1)	if voltages, tube and circuits check O.K., inspect vernier tuning condenser located at end of gang nearest the detector. Insulation often falls out allowing the plates to touch. The stage it tunes then becomes "shorted", cutting out its amplification effectiveness
Noisy	1)	defects in the audio transformers
	2)	defects in voltage divider
Audio whistle or howl	1)	shunt secondary of first a-f transf. with a 100,000-ohm resistor
	2)	try reversing the primary of this transf.
	3)	keep speaker cord away from detector and a-f tubes. Put howl arresters on tubes if necessary
Microphonics	1)	cushion entire chassis to prevent chassis and tube vibration by sound waves

KOLSTER 6F, 6J, 6K, 6L, 6N, 6R

No signals	1)	open resistor in power pack
	2)	shorted condenser in power pack (for Kolster 6K only)
Fading	1)	poor contact of volume control contact arm against resistance
	2)	clean and tighten socket prongs (Kolster 6K only)
Starting howl	1)	connect 100,000-ohm resistor across secondary of first a-f transformer
Hum	1)	shield detector tube and ground shield
Choked, Weak reception	1)	short-circuited or leaky 2-mfd. speaker output condenser
Distortion, (tubes and voltages test O.K.) (voltages on type '71 filament about 5½-volts)	1)	defective push-pull line switch. Replace with long-necked toggle switch (For Kolster 6K only)

KOLSTER-BRANDES B15, B16

Sudden "blasting" followed by "cutting out"	1	"open" grid resistors in the r-f tube circuits. Replace with 3,000-ohm wirewound units
Low volume	1)	"open" grid resistors in the r-f tube circuits. Replace with 3,000-ohm wirewound units

KOLSTER K-20

Inoperative	1)	short-circuited detector tuning condenser vernier
Weak reception	1)	open grid-suppressor resistors
Fading, Intermittent reception	1)	open-circuiting plate by-pass condenser
	2)	loose nuts on terminal strip
	3)	short-circuiting detector tuning condenser vernier
	4)	open-circuiting filament by-pass cond.
Whistling or squealing when new tubes are installed	1)	substitute a thin mica washer for the thicker mica washer in detector condenser mounted on end of gang condenser. Readjust this condenser to stop oscillation
Whistling or squealing	1)	speaker cord too near detector tube
	2)	shield power tube and ground shield

(Cont'd)

KOLSTER K-20—*(Cont'd)*

Whistling, Howling at high setting of volume control	1)	open-circuited plate or filament by-pass condenser
	2)	remove one or more small condensers shunting grid suppressors
	3)	increase value of grid suppressors
	4)	leaky neutralizing condensers across the suppressor resistors in the r-f amplifier grid leads. Replace with new trimmer condensers, setting their capacity just beyond the point of regeneration
	5)	check for open grid resistors in r-f amplifier. Replace with wire-wound units
Starting howl	1)	connect 100,000-ohm resistor across first audio secondary
	2)	try reversing primary of first a-f transf.
Reception O.K. for few minutes after turning on—followed by motorboating, distortion, cutting off—then reception "blasts" in again	1)	check for "open" 2 or 5 megohm grid leak located next to detector tube. If receiver howls with new 2-meg. leak, try value up to 5-meg.
Noisy reception	1)	sparking or arcing voltage divider
	2)	noisy audio transf. primary windings
	3)	worn resistance element in vol. control
	4)	loose nuts on terminal strip
Microphonic	1)	remove small condensers shunting grid suppressors
	2)	increase value of grid suppressors
Audio whistle	1)	place a shield on the power tube and ground it
"Frying" noises	1)	install new grid leak located directly behind the '27 detector tube
Modulation hum, Motorboating	1)	burned out grid resistor in one of the r-f stages. Check tube in that stage for an internal "short." Replace grid resistor with a 2,000-ohm unit
	2)	remove the small condensers shunting the grid suppressor resistors, one at a time, until motorboating stops

KOLSTER K-21

See also Case Histories listed for Kolster K-20

Inoperative (no detector plate voltage)	1)	check the 30,000-ohm resistor located under the power pack. This unit drops the voltage from the r-f B-plus to detector B-plus
Loud "howl" for about ten minutes after set is turned on	1)	remove extra piece of green wire connected from the control grid of the first a-f tube. This wire is laced for a way with the tuner power supply wires, but its other end is left open. Its removal will check the howl
Weak reception	1)	remove the grid suppressor in the grid circuit of the third r-f tube. Removal of the others will cause oscillation at the high-frequency end of the tuning dial
Frying noise	1)	faulty hum-control center tap on the type '26 tube filaments
Regeneration	1)	hum balancers out of adjustment. Readjust them till operation becomes normal

KOLSTER K-22, K-23, K-24, K-25, K-27, K-28

See also Case Histories listed for Kolster K-20, K-21

No reception	1)	look for loose prongs on loudspeaker plug
	2)	open circuit in voice-coil leads
	3)	shorted filter condenser in power pack
Noisy reception	1)	defective audio transformer in power pack
	2)	clean the grid leak clips, and replace the leaks with new ones
Volume control (in K-24 receiver)	1)	the volume control in this receiver is a 5,600-ohm unit shunted across the antenna and ground posts. The circuit diagram does not show it

KOLSTER CK-35

Poor selectivity over part of the tuning dial	1)	open-circuited 2,700-ohm wire-wound grid suppressor resistor in the grid circuit of the first r-f tube. Replace with a ¼-watt, 2,200-ohm metallized unit

KOLSTER K-37

"Blasting" Intermittent reception	1)	replace the grid leak with a 2 to 5-meg. unit—use the value in between these limits which eliminates audio howl

KOLSTER K-42

Weak reception (voltages and tubes O.K.)	1)	check grid cond. in detector circuit for leakage. Replace with 0.0025-mfd.

KOLSTER K-43

Inoperative	1)	open-circuited second r-f grid wire. Locate the connection and resolder it
Fading Intermittent reception	1)	leaky or intermittently open-circuiting 0.6-mfd. screen-grid by-pass condenser contained with another condenser in an oblong metallic housing having a green lead connected to the "G" terminal of the second r-f tube socket. Replace with a good quality ½- to 1-mfd. unit
	2)	faulty volume control. Test by pulling control knob out and in several times, or rotate the knob, pulling it out at the same time. The carbon section usually becomes flaked and cracks, causing variations in resistance. Disconnect the lead from the 0.0001-mfd. condenser to the resistance strip and connect this lead to the antenna post
	3)	"floating" r-f coils, loosening from their supports within the shields. Tighten coils to their supports
	4)	check soldered connections on the speaker leads and also the r-f choke in the detector plate circuit
Hum	1)	vibration of power transformer shield. Test by placing the hand firmly on the shield and noting the change. If defective, pack the space inside the shield with soft paper, thereby damping the vibration. Removing the shield entirely may be necessary. In some cases, it may be sufficient merely to tighten the lamination clamping screws
	2)	resistance of hum-control resistor across the 2½-volt filament winding too high. Replace with unit of about 15-ohms, in order to obtain a finer adjustment
	3)	unbalanced secondary windings on push-pull input transformer. Replace with a new transformer
	4)	loose terminals on power pack. Fasten down all terminals

(Cont'd)

KOLSTER K-43—*(Cont'd)*

Hum *(Cont'd.)*	5)	if filter is O.K., look for a faulty 250,000-ohm (orange) resistor connected between one terminal of the first a-f transformer secondary and the center-tap of the hum-adjuster control
Intermittent noise	1)	"shorting" of the tuning circuits—occurring between the shielding on the control-grid leads and the control-grid caps through the insulating rubbers. The shield works under the rubber. Apply rubber tape to clear up the trouble
	2)	check the tuning condenser stator and rotor plate for "shorting"
Noise	1)	worn carbon resistance element in antenna portion of dual volume control
	2)	leaky detector plate by-pass condenser
	3)	clean grid-leak clips and replace leaks with new ones

KOLSTER K-44

Intermittent reception	1)	check soldered connections on the speaker leads and also the r-f choke in the detector plate circuit

KOLSTER K-45

Distortion at high volume level	1)	voice coil windings loose and rubbing against the field coil core

KOLSTER K-60, K-62

Inoperative, Weak signals from local stations only	1)	0.00075-mfd. shunt condenser across oscillator-condenser "open." As this is an odd size, a 0.0005- and a 0.00025-mfd. condenser (in parallel with each other) may be used for replacement
Noisy reception, Intermittent rasping noises, (voltages and currents test O.K.)	1)	critical r-f or first detector circuit
	2)	defective condensers in the r-f or i-f circuits. Replace with new units
	3)	replace the r-f input coil grid lead with a piece of waxed cotton-covered wire
	4)	poor contact between coil shields and chassis. Bond them with flexible pigtails
	5)	loose grid cap clips. Replace with tight fitting clips
	6)	faulty band-pass filter
	7)	short-circuited tuning coil
Distortion	1)	leaky or faulty coupling condenser in the grid circuit of the '47 tube. If its leakage resistance is less than 100 megohms, replace it with a very high quality condenser
	2)	leaky grid filter by-pass condenser

KOLSTER K-70, K-72

See also Case Histories listed for Kolster K-80, K-82

Inoperative (plate and screen-grid voltages on all tubes but the AVC tube are below normal, and cathode voltage of AVC tube is over 250V instead of 50V)	1)	check the 200-ohm section of the voltage-divider for an open circuit

(Cont'd)

KOLSTER K-70, K-72—*(Cont'd)*

Fading to almost a whisper when tone control position is changed	1)	leaky 0.1-mfd. coupling condenser connected between the plate of the second detector tube and the plate of the pentode tube (leak does not usually show up on ordinary tests—high voltage test necessary). Replace with new unit
High-pitched whistle	1)	interaction between type '47 tube and push-pull input transformer. Bond the transformer case to the chassis in several places
Improving tone and volume	1)	if receiver does not already have a 1-mfd. 400-volt condenser across filter choke, connect one in

KOLSTER K-80, K-82, K-90, K-92

Inoperative, Weak signals from local stations only	1)	0.00075-mfd. shunt condenser across oscillator-condenser "open". As this is an odd size a 0.0005- and a 0.00025-mfd. condenser (in parallel with each other) may be used for replacement
Inoperative until AVC '24A tube is withdrawn	1)	open-circuited 2-megohm AVC grid-leak resistor. (In models 90, 92, AVC grid resistor is 1 megohm)
Fading	1)	gassy AVC tube
Noisy tuning, Whistling or squealing	1)	corroded condenser-gang rotor contacts. Solder flexible pigtail between rotor and condenser frame
Squealing, Motorboating, Noisy, Rattling	1)	poorly grounded coil shield. Corroded shield rivets
Motorboating sound on strong signals	1)	by-pass the 3,000-ohm bias resistor in the amplifier with a 0.1-mfd. condenser
High-pitched whistle	1)	interaction between type '47 tubes and push-pull input transformer. Bond the transformer case to chassis in several places
Distortion at max. volume, volume control ineffective	1)	check the continuity of the AVC grid circuit with respect to the chassis. Leakage may be present in the insulated terminal brackets employed in the AVC grid circuit
Distortion at any volume level, and no AVC action	1)	"open" 500-mmfd. AVC grid-coupling condenser connected between the plate of the i-f tube and the grid of the AVC '24A tube
Improving volume control action in K-80 and K-82 receivers	1)	replace original volume control with a 15,000-ohm potentiometer. A 1,250-ohm fixed resistor should be connected between the AVC tube cathode and the "cathode" end of this new volume control
Lack of control in K-90 and K-92 receivers	1)	check the 1-meg. resistor connected to the grid of the AVC tube for "open" condition
Volume control has time lag	1)	reduce the "time constant" of the AVC action by replacing the 0.1-mfd. time-constant condenser *BC5* (connected between the cathode and secondary of the first i-f) with a 0.02-mfd. condenser
Hum, Poor tone	1)	see if receiver contains a 1-mfd. 400-volt condenser across filter choke. If not, install one
Warm-up noise	1)	try changing the tubes around

KOLSTER K-100

Same Case Histories as those listed for Kolster K-60, K-62

KOLSTER K-110

Noise	1)	try replacing choke under 56 tube socket with a resistor of about 35,000 ohms
Hum at "loud" setting of volume control	1)	dress lead to center-tap of high voltage winding of power transformer away from volume control leads. Keep it close to chassis

KOLSTER K-130, K-132

Oscillator inoperative, (oscillator tube tests O.K.)	1)	change in value of grid condenser or grid resistor. Replace with new unit
	2)	"faulty" oscillator plate resistor. Replace with new unit
	3)	increase in value of first a-f tube plate resistor, causing a drop in plate voltage. Replace with new unit
	4)	defective first a-f transformer. Replace
Neon tuning indicator inoperative	1)	change in value of 10,000-ohm resistor between the neon tuning indicator and ground
	2)	insufficient plate voltage, due to deterioration of electrolytic filter condensers. Check all the filter condensers, and replace all "faulty" units
Low volume	1)	faulty r-f choke. Replace with a new unit
Insensitive, Poor AVC control	1)	change in value of AVC resistor. Replace with new unit

KOLSTER K-140

Weak reception, Fading	1)	change in value of 25,000-ohm, 1-watt screen-circuit resistor (*R19*) located at end of chassis farthest from power transformer, and 10,000-ohm, 1-watt unit (*R21*) located near power transformer. Replace both with 10-watt units
Impossible to align receiver due to unstable i-f amplifier	1)	align all i-f transformers to exactly 175-kc. Turn the trimmer of the one which is least stable all the way in. This gives better selectivity and stability than staggering. Locate unstable stage by placing screwdriver near each, noting in which the most change is introduced
Intermittent reception	1)	replace faulty '56 tube
Hum	1)	faulty filter condenser. Replace
Neon tuning indicator inoperative	1)	insufficient plate voltage, due to deterioration of electrolytic filter condenser. Check all the filter condensers, and replace all "faulty" units

---

LAFAYETTE

LAFAYETTE 7G Series

Buzzing noise	1)	check for "open" sensitivity control (dual unit with volume control)

LAFAYETTE 24

Signal detunes when afc control is turned	1)	readjust discriminator transformer which controls afc action

LAFAYETTE T-56

Inoperative on a-c, O.K. on batteries	1)	check 2,500-ohm 10-watt wire-wound bleeder resistor on top of chassis behind dial

LAFAYETTE M-83

Crackling noise on s.w. and weak broadcast reception	1)	replace volume control with 0.5-megohm linear control

LANG

LANG 5-tube AC-DC

Inoperative, Weak reception, Hum (plate-voltage readings on all tubes abnormally low)	1)	replace filter condensers, using a 12-mfd. unit on rectifier side and an 8-mfd. unit on load side of filter choke. Sometimes, merely adding an additional 8-mfd. electrolytic unit to the filter network eliminates the trouble

LEWOL

LEWOL LW-4

Insensitive	1)	increase in value of 2-megohm resistor connected in the grid lead of the type '6C6 detector tube. Replace

L'TATRO

L'TATRO 32-volt Receivers

Low volume, Vibrator buzz	1)	"leaky" or "shorted" condenser across plates of 84 rectifier tube (condenser located directly under 84 tube socket and covered by a tin shield). Remove the shield and condenser. Replace with 0.006-mfd. 1500-volt unit

L'TATRO UP36, ZP36 (32-volt Receivers)

See also Case History listed for L'Tatro 32-volt receivers

Weak reception	1)	grid lead to 75 tube grounded to its shield (due to thin insulation on the grid lead). Replace the lead

L'TATRO K54, NH44 (32-volt Receivers)

See also Case History listed for L'Tatro 32-volt receivers

Weak reception, Poor tone quality	1)	if 45-volt B battery checks O.K., check 10-mfd. 25-volt electrolytic condenser in cathode circuit of 75 tube for reduced capacity

LYRIC

LYRIC D

Intermittent volume, Whistling, Volume increases when light is switched on	1) 2)	defective volume control resistor add 0.25-mfd. condensers to the screen-grid and cathode by-pass units. This will cure the oscillation
Low volume	1)	check plate and grid circuit by-pass condensers
"Crackling" and "popping" noises	1)	noisy primary in first audio, or push-pull input, transformer

LYRIC J

Hum	1)	replace the 0.1-mfd. 200-volt by-pass condenser connected from '47 tube grid return to ground
Distortion	1)	open 500,000-ohm center-tapped resistor located near power transformer. Replace with two 250,000-ohm 2-watt units connected in series

LYRIC C-4, M-4

Set dead, Tubes do not light	1)	locate open-circuited filament in one of the tubes, and all the tubes will light since they are connected in series
	2)	defective 16-mfd., 150-volt electrolytic condenser mounted on the top side of the chassis and tied to the speaker frame

LYRIC LA6

Inoperative, Intermittent reception, Crackling noises	1)	check for "grounded" speaker field (field coil insulation breaks down, resulting in ground to speaker frame). Clear this "ground." Check 80 rectifier tube which may be damaged due to excessive load put on it by this trouble

LYRIC S6

Distortion, (tubes and voltages O.K.)	1)	increase in value of 200,000-ohm resistor in circuit of unshielded tube in rear of chassis. Replace with new unit
Distortion (only at low-volume setting)	1)	faulty 1-megohm resistor (brown, black and green) located on power transf.
Hum after set warms up	1)	check filter condensers
	2)	replace 0.3-megohm resistor forming part of the '24 tube plate circuit network (shunted to ground by a 0.25-mfd. condenser), and install a 5-megohm resistor in its place. Change the '47 tone control condenser from 0.01- to 0.03-mfd. to restore original deep tone
	3)	if sensitivity has decreased due to foregoing changes, realign the i-f stages at 175 kc, and the r-f at 1,500 and 600 kc

LYRIC S7

Inoperative (pentode output tube red hot)	1)	open-circuited output transformer, leaving no voltage on the plate and causing the screen-grid to carry the full load
Muffled reception, "Blare"	1)	replace 250,000-ohm resistor in the type '47 pentode tube circuit and the ¼-mfd. condenser in the plate end of the screen-grid circuit

LYRIC S8

Weak signals, Crackling noise	1)	defective a-f input transformer (even though it may test O.K.). Replace
	2)	short-circuited 0.1-mfd. condenser between the first detector grid coil and the tuning condenser
	3)	replace 0.002-mfd. condenser connected from second detector plate to cathode
	4)	shorted condenser in screen-grid circuit
Whistling at high-frequency end of dial	1)	replace the 0.1-mfd. cond. between 1st det. grid and oscill. grid coil
	2)	realign the receiver
Distortion, Speaker rattle (little or no grid bias on '47 tubes, and excessive plate current)	1)	push-pull amplifier is biased by a resistor voltage-divider across speaker field. Resistor connected from ground to the output utbe grid-return circuit is 170,000 ohms. Resistor from there to absolute B-minus is 0.5-megohms. Usually the latter resistor "opens" and must be replaced

LYRIC U-55

Oscillator operates erratically	1)	raise the oscillator plate voltage by shunting the 4,000-ohm resistor (in the center of the chassis underside) with a 7,500-ohm resistor

LYRIC A-65

Operative only over part of the dial	1)	failure of oscillator over inoperative part of the dial. Drop the value of the oscillator cathode resistor to ½ its former value
Resistors burn out in the voltage-divider system, Shift in screen voltage	1)	decrease in value of large 15,000-ohm, 2-watt (color coded) and 10,000-ohm, 1-watt (blue) resistors, causing them to draw a high plate current and burn up. Replace with new units of the proper value

LYRIC K-69

Low volume, Muffled tone	1)	short-circuited 1-mfd. condenser in detector circuit, located in dual unit next to filter block. Replace both to avoid trouble with second condenser later on
	2)	check for partial short in screen-grid condenser
Low volume (good tone)	1)	shorted condenser in screen-grid circuit

LYRIC 70, 73, 75

Hum	1)	shorted 0.5-mfd. by-pass condenser located in filter pack and connected to *red* 25,000-ohm resistor. External replacement is simple, as condenser is not connected to a common ground
Hum with distortion	1)	either of the 0.5-mfd. audio by-pass condensers "shorted." Locate by tracing the lead to the green 1,200-ohm resistor connected to first audio tube cathode

LYRIC S-80

Poor reception, Low volume, Fading	1)	change in value of 16,000-ohm resistor connected between plate and screen circuits and the 15,000-ohm resistor connected between screens and cathodes. Replace with 10-watt units

LYRIC 90

Inoperative	1)	check condenser by-passing plate supply for r-f and second a-f tubes. (This is one unit of dual 0.5-mfd. condensers in metal case)
	2)	examine terminal caps on 1,000-ohm 10-watt carbon bias resistor for 45 tubes
Weak reception, Distortion	1)	check for a "short" between plates of the '45 tubes. If so, replace the output transformer
Intermittent or noisy reception	1)	unsoldered grid leak lead to detector grid prong
	2)	unsoldered lead from r-f choke to plate prong on socket
	3)	examine terminal caps on 1,000-ohm 10-watt carbon 45 tube bias resistor for loose contact
	4)	check push-pull input transformer for "leakage" or "short" between primary and secondary windings
Excessive plate current in push-pull stage	1)	socket prongs "shorting" to chassis (set analyzer usually fails to reveal this trouble, as tester plug pushes the lug away from the metal)

LYRIC SA-90

Poor sensitivity, Low volume	1)	one-half of secondary of second push-pull transformer open-circuiting intermittently. Replace with new transformer, or disconnect the secondary connections and connect the two grid leads from the type '45 tubes in series with the 0.06-mfd., 400-volt condensers across the primary terminals of that transformer. Then connect two ½-megohm resistors in series across the grid leads of the '45s, grounding the point where they are connected in series to the chassis
Noisy reception, (sounds like defective volume control)	1)	leaky or short-circuited type '27 tube. Replace with new tube
Hum after set operates for about an hour	1)	connect a 2-mfd. condenser between the "low" side of the filter choke and ground

LYRIC 91

See Case Histories listed for Lyric SA-91 receiver

LYRIC SA-91

Inoperative, No 1st detector or i-f plate voltage, all other voltages low, D-C output shorted	1)	primary of i-f transformer grounding to can. Melt out of can and line inside with paper or tape, etc.
Inoperative, Rectifier plates get red hot	1)	primary to secondary short-circuit or primary to shield short-circuit of i-f transformers
Weak reception, Distortion	1)	change type '55 tube (which may test perfectly)
Distortion at low volume	1)	voice coil improperly centered
Distortion, Blasts at high volume,	1)	isolate grids of parallel type '2A5 tubes with second coupling condenser and grid leak
Tone control ineffective, Whistling	2)	insert 250-ohm resistor in each '2A5 grid circuit
Distortion, Grids of type '2A5 tubes glow, Low '2A5 grid bias	1)	short-circuited or leaky '2A5 cathode by-pass condenser
Whistling (especially at the high frequencies), Intermittent reception	1)	"open" 0.5-mfd. tubular condenser by-passing the r-f, first detector and i-f screen-grid circuits, and the oscillator plate circuit
Whistling, "Birdies," Unstable	1)	i-f transformer out of adjustment
No inter-station noise suppression, Microphonic	1)	short-circuited or leaky 10-mfd. first audio cathode by-pass condenser

LYRIC 96

See Case Histories listed for Lyric 90 receiver

LYRIC 99

See Case Histories listed for Lyric SA-91 receiver

LYRIC SA-120

Inoperative	1)	open-circuited 20,000-ohm screen-grid resistor. Replace with a 10-watt unit
Inoperative Weak reception, Motorboating when inter-station silencer is turned to left	1)	defect in any one of three 5-mfd., 50-volt condensers. Replace with new unit having higher voltage rating
Intermittent reception, Inoperative, No noise suppression	1)	open-circuiting or intermittent 1st audio grid-coupling condenser
Oscillator fails to track on low frequencies	1)	worn condenser gang bushing, causing worn section to push backward, throwing the condenser gang out of alignment. Place a thin washer between the bushing on the condenser gang and the condenser frame
No inter-station noise suppression action, Slightly distorted reproduction	1)	5-mfd. electrolytic cathode by-pass condenser for the '57 first audio tube leaky or short-circuited
Whistling, Motorboating on high freq.	1) 2)	i-f stage out of alignment open-circuited oscillator grid leak
Poor tone	1)	faulty 5-mfd. tubular condenser in the screen circuit of the second i-f tube. Replace with unit of higher voltage rating
	2)	short-circuited 5-mfd. condenser in cathode circuit of the suppressor tube. Replace with new unit of higher voltage rating

LYRIC SA-133

Loud hum, Grids of '2A5 tube glow	1)	grounded r-f chokes in type '82 tube plate leads
"Arcing" at high volume levels	1)	voice coils arcing to the field magnet pole-pieces. Clean and re-center voice coils. If this does not help, connect a 50-ohm resistor from the ungrounded side of the output transformer secondary to ground. If this cuts down volume too much, use higher resistance

LYRIC 450

Weak reception	1)	lugs of first r-f coil corroded. Clean and re-solder

LYRIC 454A

Inoperative over most of short-wave band	1)	check capacity of 2-mfd., 350-volt condenser. Replace it if it has lost capacity

LYRIC U-500, V-500

Hum	1)	asbestos which insulates series line resistor from retainer absorbs moisture, causing leakage and a-c hum. Change the mounting of the series line resistor by insulating the metal retainer of the resistor from the chassis by means of *fibre* washers

LYRIC 900

See Case Histories listed for Lyric SA-91 receiver

LYRIC 1200

See Case Histories listed for Lyric SA-120 receiver

LYRIC 1300

See Case Histories listed for Lyric SA-133 receiver

MACY

MACY MB-9 (Twin Speaker)

Inoperative (power transf. burned out)	1)	"shorted" field in the large speaker due to inside terminal "shorting" to core. Install new lead and insulate coil from the core

MAJESTIC-FORD Auto Radios

(See Case Histories listed under FORD-MAJESTIC)

MAJESTIC

MAJESTIC RECEIVERS—General Servicing Notes

Models using G2 tube	1)	if G2 replacement tubes are not readily available, use a '35 or '24 tube instead. These will be found satisfactory—including the AVC operation
Models using pilot light as resonance indicator	1)	"inoperative," or distorted reception, caused by "open" or "short" in the center winding on the indicator transformer in series with the r-f and i-f plate circuits. For temporary repair, "short" this winding and use a 3.2-volt pilot until a new transformer can be obtained
Noisy tuning in early models	1)	peeling of surface of tuning condenser plates, causing numerous "shorts". Remove all connections from condensers and burn off with high voltage while rotating the condenser plates

MAJESTIC "Charley McCarthy" 1, 2

Intermittent reception, Fading	1) 2)	resolder connection to grid cap of 6Q7 tube check for faulty audio coupling condenser

MAJESTIC 3C80

Intermittent reception, Squealing, Howling	1)	faulty prong contacts in 6Q7G tube socket. Replace socket

MAJESTIC 7

Intermittent reception, Fading	1)	r-f by-pass condenser (located near front of chassis) "open." Disconnect the double lead on this condenser and connect a 0.5-mfd., 300-volt replacement condenser between this double lead and ground

MAJESTIC 9P3

Inoperative	1)	detector plate choke "open." Replace with a 25,000-ohm, 1-watt resistor

MAJESTIC 15, 15B

Inoperative	1)	burnt-out antenna coil. Replace
	2)	defective antenna coupling condenser
	3)	open- or short-circuited 0.01-mfd. primary buffer condenser. Replace with a unit of higher voltage rating
	4)	check the 0.1-mfd. by-pass condenser in the plate circuit of the oscillator-detector. If this "shorts," it usually chars the 2,000-ohm plate voltage dropping resistor
Inoperative, (no plate voltages on r-f & i-f tubes)	1)	short-circuited i-f transformer
Inoperative, (tubes and voltages test O.K.)	1)	unsuitable type '24A oscillator tube (even though it tests O.K.). Replace by substitution
Inoperative on part of dial	1)	change the value of the first detector-oscillator cathode bias resistor to 5,000-ohms, replacing the old 10,000-ohm unit
Irregular volume, "Dead spots" on lower half of dial	1)	try replacing the G51 tube with a '24A, and ground the cathode at its by-pass connection
Weak, Poor selectivity	1)	partial "open," or "high-resistance" connection in one of the i-f transformers. A difference of only 50 ohms from the normal 150-ohm resistance of these coils is sufficient to cause weakened reception and poor selectivity
Weakened reception	1)	connect a 0.0005-mfd. fixed condenser between the grid of the first tube and the secondary of the pre-selector coil. Realign the receiver
Whistling (not traceable to filter condensers or resistors)	1)	replace detector coupling condenser behind resistor board rear wall with 0.05-mfd., 400-volt type
	2)	remove grounding plate at rear of tuning condenser. Clean contact & shaft
Noisy reception, Intermittent reception	1)	corroded or high-resistance connection at the i-f coils. Test this by charging an 8-mfd. condenser and flashing each coil. The coil is in good condition if it stands this test.
Motorboating-sound and hum at low-frequency end of dial	1)	"open" input filter condenser. Inspect the grounding connection before removing this unit

MAJESTIC 20

Inoperative, Weak, Poor selectivity (resistance from plate of i-f tube to chassis less than 30,000-ohms)	1)	"shorted" 0.1-mfd. by-pass condenser in first or second i-f transformer can (indicated by no plate voltage on the screen-grid tubes). Remove i-f transf. can from chassis and cut two half-inch slits (at right angles to each other) in the side near red lead. Bend metal back and cut out the faulty condenser bringing out the red lead for connection to a new external condenser. Replace the can and install a new 0.1-mfd., 600-volt condenser on the outside of the can underneath the chassis
	2)	short-circuited 0.1-mfd. plate by-pass condenser within second i-f transformer
	3)	open-circuited 10,000-ohm oscillator grid leak
	4)	absence of oscillator plate voltage is caused by an open plate winding on the oscillator coil. Replace entire coil

(Cont'd)

MAJESTIC 20—*(Cont'd)*

Inoperative, Weak, (tone control works only in one position)	1)	if the plate voltage on the 51's is low (or absent) replace the shorted tone-control condenser with a 0.022-mfd. unit and the shorted 0.1-mfd. condenser in the i-f transformer. Remove the chassis side-plate to make this replacement
Lack of sensitivity	1)	check the '35 or '51 in the first detector socket. Try replacing it with a '24A. (G51's and G35's may be replaced with G24's)
Unstable operation	1)	10,000-ohm oscillator grid leak "open"
Tone control inoperative	1)	contact arm inside control "frozen" to element, causing the entire stationary mechanism to turn with the shaft. Repair or replace with new unit
Section of voltage divider heats up excessively	1)	short-circuited 0.1-mfd. by-pass condenser in the i-f transformer. Connect new unit externally as directed above
Sizzling and frying noises	1)	tone control is usually responsible. Open the chassis at the tone control side (left side from rear) by taking out the side flap. Clip the tone-control condenser lead. If customer wants a tone control, replace the condenser with a 0.03-mfd., 600-volt tubular type
Hum	1)	replace by-pass condenser across the 35,000-ohm resistor used for biasing the second detector. This condenser is one of the two 0.4-mfd. units contained in a single case

MAJESTIC 21, 22, 23

Inoperative, Weak	1)	see remedy for this same trouble listed for Majestic 20
Inoperative, Weak, (tone control works only in one position)	1)	see remedy for this same trouble listed for Majestic 20
Unstable operation	1)	10,000-ohm oscillator grid leak "open"
Hum	1)	replace by-pass condenser across the 35,000-ohm resistor used for biasing the second detector. This condenser is one of the two 0.4-mfd. units contained in a single case

MAJESTIC 25

Weak, lack of sensitivity	1)	check the '35 or '51 tube in the first detector socket. Try replacing with a '24A. (G51's and G35's may be replaced with G24's)
Hum (not traceable to filter)	1)	check to see if pilot soldering lugs are "grounding" to the bracket. This removes the bias on the '47
Distortion with volume control at minimum setting for stations between 550- and 700-kc. O.K. with volume control at maximum setting	1)	primary of first i-f transformer slightly off balance
	2)	i-f amplifier out of alignment

MAJESTIC 30

Type '80 rectifier tube filament burns out on one side	1)	short-circuited 2-mfd. filter condenser between the orange lead of the type '80 tube filament terminal and the filter pack. Replace with a new 600-volt unit
Hum	1)	check for "open" or "shorted" filter choke tuning condenser
Fading	1)	"leaky" 0.04-mfd. oscillator coupling condenser connected from 1st det. cathode to tap on oscillator coil

MAJESTIC 35

Weak, lack of sensitivity	1)	check the '35 or '51 tube in the first detector socket. Try replacing with a '24A. (G51's and G35's may be replaced with G24's)

MAJESTIC 39

Intermittent reception, Fading	1)	check and replace audio coupling condenser

MAJESTIC 44, 49

Inoperative	1)	if primary circuit of power transf. tests "open" from a-c line cord plug, check the line fuse before deciding the transf. is "open". Chassis must be pulled out to make replacement
Inoperative (pink glow in rectifier)	1)	rectifier socket prongs too close to chassis and arcing over to chassis. Replace socket, cutting out chassis to provide more clearance for prongs
Distortion	1)	"open" or "decreased-capacity" in electrolytic filter block
Hum, Whistling	1)	"open" section in 6-4-mfd. electrolytic condenser block
	2)	change the 0.01-mfd. condenser on the power switch to a 0.02-mfd. unit

MAJESTIC 50

See also Case Histories listed for Majestic 52

Inoperative	1)	replace the small uncased 0.15-mfd. by-pass condenser going to the 2,680-ohm resistor on the voltage divider
Inoperative (no plate voltage on second detector— other plate voltages about 15 volts below normal)	1)	"shorted" 1-mfd. condenser which connects from the junction of the a-f transformer primary and the 25,000-ohm voltage-dropping resistor. Reach them by removing small plate in back of chassis directly below mounting of '45 and '80 tubes. Replace both units
Inoperative on the lower frequencies	1)	check for "shorting" of the plates in the oscillator section of the tuning condenser gang
No control of tuning condensers	1)	replace drive cable
Intermittent reception and noisy	1)	check 0.04-mfd. oscillator coupling condenser. Replace with a mica type of condenser
No control of volume	1)	if volume cannot be reduced, connect a 10,000-ohm resistor from the centertap of the front section of the control to the white lead on the rear of the control

(Cont'd)

MAJESTIC 50—*(Cont'd)*

Fading	1)	check first a-f transformer (it is condenser-choke coupled)
Noisy reception	1)	faulty volume control
Motorboating sound	1)	check 0.001-mfd. grid condenser and 100,000-ohm grid resistor on 27 oscillator for change in value

MAJESTIC 51

Inoperative (no plate voltage on second detector— other plate voltages about 15 volts below normal)	1)	"shorted" 1-mfd. condenser which connects from the junction of the a-f transformer primary and the 25,000-ohm voltage-dropping resistor. Reach them by removing small plate in back of chassis directly below mounting of '45 and '80 tubes. Replace both units
Inoperative on the lower frequencies	1)	check for "shorting" of the plates in the oscillator section of the tuning condenser gang

MAJESTIC 52

Inoperative (no plate voltage on second detector— other plate voltages about 15 volts below normal)	1)	"shorted" 1mfd. condenser which connects from the junction of the a-f transformer primary and the 25,000-ohm voltage-dropping resistor. Reach them by removing small plate in back of chassis directly below mounting of '45 and '80 tubes. Replace both units
Inoperative on the lower frequencies	1)	check for "shorting" of the plates in the oscillator section of the tuning condenser gang
Fading, Intermittent reception, Hum	1)	"shorted" or "leaky" 0.04-mfd. condenser between first-detector cathode and the tap on the grid section of the oscillator coil
Fading (rapid)	1)	check tubes
	2)	if tubes check O.K., check the cathode by-pass condenser in the second detector circuit (condenser is located inside of the chassis)
Poor sensitivity, Tuning dial off calibration	1)	r-f and oscillator circuits out of alignment
Hum	1)	open-circuited filter choke "tuning" condenser
	2)	"shorted" filter choke "tuning" condenser

MAJESTIC 55

Inoperative	1)	"faulty" electrolytic filter condensers. Replace both condensers
Inoperative, Motorboating sound	1)	short-circuit or leakage between primary and secondary of last i-f transformer whose primary is in the plate circuit of the 6B7S tube. For a quick check, make a resistance reading between the plate contact of the 6B7S socket and the diode contact adjacent to the screen-grid contact. The reading obtained should be well over 2 megohms. A much lower reading indicates leakage between the prim. and sec. of the last i-f transf.

(Cont'd)

MAJESTIC 55—*(Cont'd)*

Intermittent reception or fading (which may be overcome by snapping the line switch)	1)	remove (or "short" out) the 3-megohm control-grid filter resistor from the '6A7 secondary return circuit
	2)	leaky condensers in block located on outside of chassis near speaker
	3)	open-circuits or loose ends on tubular condensers. Check each one carefully
Weak reception, Poor sensitivity	1)	shorted 0.003-mfd. tone-control condenser. When this happens, inspect the tone control, as a shorted condenser allows high voltage to pass through it, ruining the carbon strip; (tone-control value 50,000-ohms)
	2)	check '35 or '51 in first detector socket. Try replacing with a '24A. (G51's and G35's may be replaced with G24's)
	3)	connect a 0.0005-mfd. condenser between the grid of the first tube and the secondary of the pre-selector coil. Realign
Intermittent and noisy reception	1)	short-circuit between wire from variable condenser gang and connecting lug on can of a-f by-pass condenser located under the chassis, resulting from sharp edge of lug cutting through the insulation of wire. Tape up the cut insulation and change the position of the wire
Sharp metallic click when set is switched on	1)	loose bolts holding power transformer together and to chassis. Tighten them so that metal plate of the assembly does not clatter against the core
Crackling, noisy	1)	primary winding of oscillator coil breaking down. Replace with new unit
Whistling (not traceable to filter cond. or resist.)	1)	replace detector coupling condenser (behind resistor board rear wall) with a 0.05-mfd., 400-volt unit
Hum	1)	pilot light socket "shorted" to ground. Insulate the socket from ground. Make sure the chassis bolts are securely fastened

MAJESTIC 59

See also Case History listed for Majestic 55 receiver

Intermittent reception or fading (which may be overcome by snapping the line switch)	1)	remove (or "short" out) the 3-megohm control-grid filter resistor from the '6A7 secondary return circuit

MAJESTIC "60"—Series Receivers

Inoperative	1)	short-circuited r-f choke in the second detector stage
	2)	check for "shorting" of lead from '80 filament terminal to "ground," or to the 110-volt line. Rubber covering on this wire softens from heat, or the line-voltage taps cut through it
Inoperative unless type '24 AVC tube is withdrawn, (set then operates but volume is uncontrollable	1)	"open" control-grid circuit of AVC tube. Look for poor cnonection on terminal strip beside the AVC tube socket. Trouble causes the tube to draw a high plate current since its grid bias becomes zero. This places a high grid bias on the controlled tubes

(Cont'd)

MAJESTIC "60"-Series Receivers—*(Cont'd)*

Receiver stops playing suddenly, tuning meter needle swings clear over to stop	1)	"shorting" of 0.1-mfd. by-pass condenser in plate circuit of i-f tube. Unsolder leads from i-f transformer, remove it from chassis. Heat it carefully to melt out the wax. Locate the *red* lead, melt the wax from it. Clip and tape this lead, reassemble the transformer with it projecting from case. Mount a 0.1-mfd. condenser externally and connect it from this *red* lead to ground
Fading, Erratic meter operation, Weak reception	1)	leakage between porous cotton-covered leads
	2)	leaky 0.067-mfd. r-f secondary return by-pass condensers
	3)	leaky 0.067 first detector secondary-return by-pass condenser
	4)	porous 57,000-ohm blue carbon resistor
	5)	absorption of moisture by cotton-covered leads and resistors throwing receiver out of alignment. It is advisable to rewire the entire receiver using rubber-covered wire for tuning condenser leads, control-grid leads, AVC plate leads, r-f and first detector secondary return leads; new, good condensers and wire-wound resistors
Low volume, Poor tone	1)	short-circuited i-f condenser
Low sensitivity	1)	check '35 or '51 tube in first-detector socket. Try replacing with a '24A tube (G51's and G35's may be replaced with G24's)
	2)	connect a 250-mmfd. mica condenser between the contact arm of the 10,000-ohm volume control and the "low" end of the variable r-f coil in the first r-f stage. This will increase the sensitivity of the receiver and also reduce noise

MAJESTIC 61

See also the Case Histories listed under Majestic "60"-Series Receivers

Temporarily inoperative when volume control is set near "loud" end—O.K. otherwise	1)	"leaky" by-pass condensers by-passing the resistors on the grid returns of the automatic volume controlled tubes. Replace

MAJESTIC 62, 63, 65

See also the Case Histories listed under Majestic "60"-Series Receivers

MAJESTIC 66 Auto Radio

See also the Case Histories listed under Majestic "60"-Series Receivers

Inoperative	1)	no screen voltages. Check for "open" 10,000-ohm screen-grid resistor (just below 6E7 and 6C7 tubes). Replace with one having higher wattage rating
	2)	if plate and screen voltages are below normal, check the center-tapped filter choke (underneath the chassis near the A-battery female cable connector). If grounded side is open, (or partially open), there is no grid return to ground for the output tube, and lack of bias increases the plate current to a value which causes the drop through the choke to become abnormally great

(Cont'd over)

MAJESTIC 66 Auto Radio—(*Cont'd*)

Inoperative (*Cont'd.*)	3)	if voltages check O.K., look for "open" 0.03-mfd. tubular type grid-return condensers across the 300,000-ohm AVC resistors (marked *C1* and *C2* on manufacturer's diagram, and hanging across the first two r-f coils)
	4)	if voltages are normal, try removing i-f coil shield, placing insulating paper around coil frame
	5)	if receiver has become wet, check the rectifier socket for carbonization or breakdown due to "arcing." Also look for electrolysis on the red lead going to the B choke. This opens up the soldered joint inside the choke, where the lead connects to the fine wire of the choke winding. The symptom of this trouble is high voltage on the control-grid of the '89 tube. Cut into the first layer of the insulating paper around the choke until the two leads are exposed. The choke winding going to the lead will be found disconnected. Resolder it
Inoperative, Weak	1)	when working on receiver be careful to replace the grid caps on the '89 output tube and the 6C7 first-audio tube in the proper order. These leads must be *crossed* for proper operation. Unless they are put back this way, the first a-f stage will be cut out, causing weak response even though everything in the receiver is apparently O.K.
Fuse blows (voltages test O.K.)	1)	faulty type 6Y5 rectifier tube. Replace even though it may test O.K.
Fuse blows (vibrator sticks)	1)	check for "shorted" filter condenser or "open" filter choke. Choke has centertap —so check both sides
	2)	"open" 10,000-ohm screen bleeder resistor
Intermittent reception, Inoperative	1)	faulty type 6Y5 rectifier tube. Replace if it tests O.K.
	2)	broken shielded ground wire lead inside of plug at rear of set. Take off plug, unscrew and solder on the wire. This trouble is usually evidenced by set playing intermittently while car rides over bumpy road
Low volume, Fading, Intermittent reception	1)	faulty 0.03-mfd. coupling condensers connected between the grid returns of the first and second r-f coils and the ground. The trouble is usually a poor connection between the pigtail leads and the tin-foil of the condenser
	2)	the above also applies for the 0.03-mfd. coupling condensers in the diode and triode scetions of the type 6C7 tube
	3)	if vibrator ceases to function as set fades out, but pilot light bulb still lights, examine the fuse holders for corrosion
	4)	if tubes and voltages check O.K., check for an "open" choke in second r-f transformer. Test between plates of G-6C7 tube and ground
	5)	check 0.03-mfd. condenser (C-1 on diagram) in the secondary grid-return of the antenna coil. This unit frequently "opens"
Weak reception, Noisy reception	1)	insulate the i-f coil frame from its shield
	2)	high-resistance connections at the "B" filter choke terminals. Resolder the connections, replacing the leads with rubber-covered wire

(*Cont'd*)

MAJESTIC 66 Auto Radio—(*Cont'd*)

"Buzzing" noise	1)	replace the 6Y5 mercury type rectifier with a 6Y5 (like a Sylvania 6Y5 tube) that is not of the mercury type
Excessive noise (sounding like vibrator noise)	1)	look for loose or broken connection on the shielding over the aerial lead. Resolder it where it goes through the eyelet on the metal case
Excessive "noise" from vibrator	1)	if vibrator, condensers and choke are in good condition, connect a 0.25-mfd. condenser from one of the B-plus leads to "ground." Connecting a 60-ohm carbon resistor in series with the small by-pass condensers connected across the vibrator primary circuit may also help. Also check the 0.3-mfd. cartridge type condenser (held by its protruding leads) connected from one side of the B-supply fuse to "ground." Vibration often causes it to "open," or breaks a lead
Whistling and squealing, (on high-freq. end)	1)	change the 6A7 tube (even though it tests O.K. in a tube checker)
Distortion	1)	replace tubular 10-mfd. condenser
	2)	test 0.03-mfd. coupling condenser and replace if faulty
	3)	if set distorts with the top in place but not when it is removed, loosen the two speaker mounting screws, place cardboard or fibre shims under speaker shell and tighten the screws. It may be necessary to readjust the speaker
Installation hints	1)	to greatly reduce motor noise pickup conducted to chassis by pilot light lead make it easier to remove the set, and permit the use of the set without the pilot light burning in daylight proceed as follows: Before making the installation remove the remote control pilot light feed wire from the chassis by unsoldering it inside or cutting it off just outside the case. When the remote control unit has been mounted connect the pilot lamp wire to the tail lamp post on the lighting switch by holding wire to each post and snapping switch through its various positions

MAJESTIC 67, 68, 69

See also the Case Histories listed under Majestic "60"-Series Receivers

MAJESTIC 70

Inoperative	1)	"shorted" r-f by-pass condenser in chassis
	2)	"shorted" filter condenser between "B+ r-f," and "ground" in power pack
	3)	faulty "on-off" switch
	4)	"open-circuited" ballast resistor or its connecting leads
	5)	a power-transformer "short" often occurs, overheating the ballast resistor. "Short" the ballast resistor and apply full 110 volts to the receiver. In some cases this will burn out the short. If not, replace the power transformer — and the ballast resistor if it has been seriously overheated

(*Cont'd*)

MAJESTIC 70—(*Cont'd*)

Intermittent reception	1)	look for a fungus growth or mould on fabric insulation of r-f wiring. Rewire with rubber and varnished-cambric insulated wire
	2)	the nuts on the power pack terminal strip should be tightened with a pair of pliers. Start with the bottom strip by removing the top one first. When the lower ones are all tight put the top one back into place and thoroughly tighten the top ones
Low volume, Insensitive, Noisy reception	1)	by-pass part of the signal directly to the coil without disturbing the action of the volume control by connecting a 0.00025-mfd. condenser between the contact arm of the volume control and the low end of the variable r-f coil in the first r-f stage
	2)	dirty volume control resistor. Go over the contact arm, wiper and shaft with a chamois cloth. This may clear up quite a bit of the trouble
	3)	replace the 550-ohm bias resistor of the r-f and detector tubes with a 350-ohm resistor
	4)	weak and distorted reception which clears up when aerial lead is put on the grid of the 2nd or 3rd r-f tube is usually caused by an "open" in the volume control resistance element
	5)	look for a fungus growth or mould on fabric insulation of r-f wiring, no rubber under fabric of wire. Re-wire with rubber and varnished-cambric insulated wire
	6)	to increase snesitivity and volume, connect a 250-mmfd. mica condenser between contact arm of the 10,000-ohm volume control and the "low" end of the variable r-f coil in the first r-f stage. This will also reduce noise
	7)	if voltage regulator becomes excessively hot and there is a blue glow in the rectifying tube, check the 2-mfd. first filter condenser for "short." If all of the first three filter condensers are blown (a low-resistance indication when checking between '80 tube filament and ground reveals this) replace them with 4-2-2 or 4-2-4 mfd. 500-volt units
Frying noise (similar to that of a noisy audio transformer)	1)	corroded and loose leads in the ballast resistor unit. Clean and check connection of resistance wire leads
Crackles and howls when turned on	1)	replace defective type '26 r-f tubes even if faults do not show up in the tube tester. Try substituting new tubes
Noise and Fading	1)	loose nuts on the power pack terminal strip. Tighten securely, starting with the bottom strip by removing the top one first. When the lower ones are all tight put the top one back into place and thoroughly tighten the top ones
Fading several minutes after being placed in operation, (snapping the switch off and on restores operation to normal for a few minutes)	1)	defective type '26 tubes. Replace by substitution
	2)	tighten all hexagonal nuts under the top power pack terminal strip
	3)	open '26 bias resistor
	4)	faulty local-distance switch
	5)	faulty 0.5-mfd. r-f and detector by-pass condensers (located inside receiver chassis)

(*Cont'd*)

MAJESTIC 70—(*Cont'd*)

Distortion (no grid bias voltage on type 71 tubes)	1)	pilot light socket short-circuiting to ground
Poor tone, Distortion	1)	replace original dynamic speaker with a new unit, having a field resistance of 2,730 ohms and a voice-coil resistance of 20 ohms. If the latter resistance is not available re-wind the voice coil
	2)	this model emphasizes the base notes. Loosen the speaker bolts and move the speaker back about one inch from the baffle. This will reduce the low-note reproduction and improve the tone Another method is to break the lead from the first a-f transf. to grid of first audio tube and insert a 0.0003-mfd. mica condenser in series with this circuit. Then connect a resistor of from 0.5 to 1.0 megohms from the grid to ground. This is really a high-pass filter, and by choosing a different value of condenser any amount of bass may be allowed to pass—remembering that the *smaller* the condenser the *less* bass will be passed
	3)	check for "open" or "grounded" C-bias resistor for the output stage
	4)	open seam on speaker cones. Repair with a good grade of paper cement
	5)	install a 500,000-ohm resistor across the grids of the '71A tubes
Speaker rattle	1)	look for loose flexible leads at the first cone contact. Re-center cone, using three or four shims and resetting spider clamp screw
Excessive hum	1)	use a '56 tube in place of the '27 for the detector—or place a shield over the detector tube
	2)	in older sets, the center tap to the filament of the '80 sometimes breaks inside the container. The remedy is to take plus B from one of the filament leads
Motorboating sound, Distortion	1)	if accompanied by lack of detector grid bias voltage, check for a "shorted" det. grid bias by-pass condenser
Buzzing noise (intermittently)	1)	check '27 tube for a cathode-to-heater "short"
	2)	a buzzing noise on bass notes is usually due to an open seam in the speaker cone head
Volume control erratic	1)	remove cap on volume control, bend outer contact arm slightly until it barely touches the resistance element
Replacing dial cables	1)	loosen and disconnect the tuning gang assembly, lifting the entire unit out of the chassis. Start by winding the cable around the rear drum first, and finishing on the front drum

MAJESTIC 70B

No grid voltage on '71's	1)	check pilot light socket for "short" to ground
Crackling and howling when set is turned on	1)	check r-f '26 tubes. Filaments often expand when hot, shorting to grid, and opening up again when permitted to cool

MAJESTIC 71

See also Case Histories listed for Majestic 70

Inoperative	1)	if plate voltage on r-f and detector tubes is zero, check the continuity of the various sections of the speaker field coil for "opens" (the field serves as part of the voltage divider)
Poor tone, "Buzzing" on bass notes	1)	seam of speaker cone head opened a trifle, causing a buzzing sound on bass notes. Cement the seam

MAJESTIC 72

See Case Histories listed for Majestic 70

MAJESTIC 75

See Case Histories listed for Majestic 55 and 59 receivers

MAJESTIC 80

Low volume, Insensitive, Noisy reception	1)	by-pass part of the signal directly to the coil without disturbing the action of the volume control by connecting a 0.00025-mfd. mica condenser between the contact arm of the volume control and the low end of the variable r-f coil in the first r-f stage
	2)	dirty volume control resistor. Go over the contact arm, wiper and shaft with a chamois cloth. This may clear up quite a bit of the trouble

MAJESTIC "90"-Series Receivers

See also Case Histories listed for Majestic 70, 91, 92, 93

Inoperative (no plate voltages)	1)	shorted filter condenser (2-mfd.) in pack, connected from black lead to green lead through the 2,000-ohm choke to the red lead. Breakdown of this condenser usually results in current overload which damages the choke. Replace both. (The choke is located in the condenser back of the power pack. One lead is connected internally to the junction of the second choke and the speaker field. The other is brought out to a separate lug.) (The later sets use a 35,000-ohm resistor instead of the choke)
	2)	"open" 2,000-ohm filter choke
	3)	check variable resistor located on the end of the condenser gang. Many of these receivers operate better when these resistors are removed and the loose wire carried to "ground"
	4)	lack of plate voltage on '45 tubes usually indicates an "open" 800-ohm bias resistor, an "open" in its connection to chassis, or an "open" primary in the output transformer
Intermittent reception	1)	corroded 1.6-ohm center-tapped resistor connected across the type '27 heaters. Replace with a new unit
	2)	check voice coil for intermittent "open" under the binding tape
	3)	replace the two 0.5-mfd. condensers located on the inside of the chassis wall
Intermittent reception, Fading, (disappears when light in house is switched on, when chassis is touched and when analyzer plug is inserted for testing)	1)	defective cathode by-pass condensers. Test for defective units and replace where necessary

(Cont'd over)

MAJESTIC "90"-Series Receivers—*(Cont'd)*

Fading, with signal coming back abruptly (also "squealing" at high-frequency dial settings)	1)	"leaky," "shorting," or "open-circuiting" 0.5-mfd. r-f plate by-pass condensers. Replace with 0.5-mfd., 400-volt type cartridge condensers
	2)	if necessary, also replace all three 0.5-mfd. condensers which by-pass the r-f and detector cathode circuits. These condensers are all in metal cases, riveted to the inside of the side of the metal chassis
	3)	faulty local-distance switch
	4)	faulty volume compensator on end of tuning condenser shaft
Fading after operating for about one hour	1)	partially short-circuited 0.5-mfd. r-f by-pass condenser located at front beneath the chassis. Replace with a new unit
Weak reception	1)	shorted detector filter condenser in block in power pack. Disconnect leads, then solder a 2,000-ohm resistor between "B+ HIGH" and "B+ DETECTOR" (externally) and a 2-mfd. condenser between "B+ DETECTOR" and "grid"
	2)	re-balance and re-neutralize circuits
	3)	worn-out sensitivity equalizer, which is a variable resistance working together with the condenser shaft. Replace *Note*: if the new equalizer resistor is thicker than old one and throws the condenser shaft out of position, remove the metal back-plate on equalizer, allowing condenser shield to take its place
	4)	"open" r-f choke in antenna stage. This will result in abnormal plate current for the '27 first r-f tube—and no grid bias
Whistling with volume control at maximum setting, Very low or no plate voltage on the detector tube	1)	short-circuited by-pass condenser in the detector B-plus lead. This will also cause a burnt-out decoupling resistor. Replace the latter with a 35,000-ohm unit and the former with a 4-mfd., 800-volt metal-encased paper-type unit fastened beside the rectifier tube
Violent whistling on high frequencies with volume control at maximum setting	1)	shunt a 0.25- to 0.5-mfd. condenser across each of the r-f by-pass condensers located beneath the chassis (these are large tin-encased units)
Excessive voltages	1)	carefully inspect volume compensator on end of tuning condenser shaft as it often works loose and remains in the high-resistance position. Tighten set-screw with the dial turned to zero
Tunable hum	1)	defective r-f choke in the antenna circuit as a result of lightning, etc. Replace with a new unit
	2)	"open" filter condenser
Hum (sounds like noise from small motor)	1)	poor ground connection
	2)	antenna and ground connections reversed
Hum, with weak, distorted reception	1)	inspect the 1.6-ohm "balancer." If it is hot, check for a "short" to chassis
	2)	check '27 tubes for cathode-to-heater shorts
Intermittent buzz, (loud and irritating)	1)	high-resistance connection between the resistance wire of the ballast unit and the base prong. Clean and tighten connection

(Cont'd)

MAJESTIC "90"-Series Receivers—*(Cont'd)*

Speaker rattle, or buzz, Distortion	1)	smear the seam of the speaker cone with cone cement
"Burping" at high volume	1)	poorly matched '45 tubes
Motorboating sound	1)	faulty 0.5-mfd. r-f by-pass condenser
	2)	if detector grid bias is zero, check 1-mfd. by-pass condenser across the detector bias resistor

MAJESTIC 90B

See also Case Histories listed under Majestic "90"-Series Receivers

Inoperative	1)	if there is no plate voltage, try disconnecting the leads from the power pack and turn set on for about 1 minute. This often cures the trouble
Intermittent reception	1)	poorly soldered connections, around coupler coil. (Resolder)
	2)	poorly soldered connections of partitions in set chassis. (Install new straps and resolder)
	3)	cathode bias condensers, open or leaky. Replace
	4)	faulty choke in r-f lead. Try shorting out the choke
Weak, fading	1)	0.001-mfd. condenser in the antenna stage "shorted"
Fading	1)	replace the two cathode by-pass and two plate by-pass condensers in the r-f circuits. All are of 0.5-mfd. capacity. Use 400-v. units for the plate circuits
	2)	replace detector cathode by-pass condenser
	3)	check the '27 tubes
Hum, Fading	1)	lift the rubber-covered wires of the cable so they clear the 116-ohm, non-inductive center tap resistor
	2)	hum which sounds like noise from a small motor. See that antenna and ground wires have not been reversed, or that ground connection has not gone bad
Whistling at frequencies above about 1,000 kc	1)	if tubes, condensers and resistors all check O.K., check each section of the tuning condenser for dirty or corroded rotor contacts. Clean the spring wipers, spring washer, and contact surfaces on the dial drive assembly. The dial will have to be removed to get at the spring washer
Noise, Motorboating sound	1)	faulty 0.5-mfd. r-f by-pass condenser

MAJESTIC 91, 92, 93

See also the Case Histories listed under Majestic "90"-Series Receivers

Inoperative	1)	lugs on audio transformers or phono input transformer grounding to core
	2)	loose power pack terminal-strip nuts
	3)	broken carbon resistance element of equalizer control
	4)	open-circuited detector filter choke or resistor (in condenser block) in power pack
	5)	check variable resistor located on end of condenser gang. Many sets work better if this is removed and loose wire carried to "ground"

(Cont'd)

MAJESTIC 91, 92, 93—*(Cont'd)*

Inoperative *(Cont'd.)*	6)	power transformer "short" causing ballast resistor to get red hot ('80 tube fails to light). Remove ballast resistor and "short" the terminals. Then apply full 110 volts to the set. The added voltage applied burns out the "short"
	7)	check variable volume compensator resistor located on end of condenser gang. Many sets work better when this is removed and loose wire is connected to ground
Intermittent reception	1)	worn carbon element in equalizer control mounted on condenser-gang shaft
Weak reception, (low plate voltage)	1)	leaky or short-circuited detector plate-voltage-supply filter condenser
Fading, Noise	1)	faulty volume compensator on end of tuning condenser shaft
	2)	loose nuts on power pack terminal strip. Tighten all nuts securely
Noisy tuning	1)	burrs on tuning condenser plates (burn with high voltage—disconnect all leads)
Motorboating sound	1)	inspect flexible cable lead soldered to sliding arm attached to trimmer cup. This wire wears and breaks after a time
Slipping dial drive	1)	replace with the new Majestic dial drive having heavy metal bearings
Loud hum modulating signal—disappears when station is tuned out	1)	remove cover from power pack. Connect a 0.1-mfd. condenser from ground to one side of a-c line. Try both sides, as one is usually more effective than the other
"Frying" noises	1)	take ballast resistor apart and disconnect long screw running through porcelain insulator. Clean screw and top of ballast with sandpaper. Reassemble

MAJESTIC 95

Intermittent reception (oscillator ceases to function)	1)	short-circuit the resistor (*R8*) in the A-minus lead. *Note*: This is only possible if a 2-volt storage cell is used for the "A" supply

MAJESTIC 100B

No radio reception, Phonograph operation O.K.	1)	continuous use of the switch breaks the bare, twisted wire which connects inside the switch to chassis, for ground. Solder a lead from terminal No. 1 to ground (switch is numbered from 1 to 12)
Intermittent reception	1)	check the 1-mfd. by-pass condensers across the cathode resistors to ground (there are two in metal containers)
Noise, Motorboating sound	1)	faulty 0.5-mfd. r-f by-pass condenser

MAJESTIC 101, 102, 103

See also Case Histories listed for Majestic 91, 92, 93

Fading	1)	inspect pickup transformer mounted on right of cabinet midway between shelves supporting chassis and speaker. If cardboard covering one end of unit is warped, one of the terminal lugs will generally be found "grounding" to the transformer core. Unsolder the lead from the terminal lug, and bring the wire up directly through the hole in the cardboard Now resolder it in place

MAJESTIC 105

Same Case Histories as those listed for Majestic 95

MAJESTIC 110

Inoperative (no B-voltages)	1)	check the 50-ohm resistance in the cathode circuit of the '37 AVC tube. Replace with a 2-watt resistor

MAJESTIC 112

Inoperative, Weak	1)	"shorted" 0.1-mfd. by-pass condenser contained in the i-f transf. can. Remove the transf. by drilling out rivets; lift off cover; heat and remove contents. Replace the condenser with a 0.1-mfd. 400-volt tubular unit. Also replace the 10,000-ohm 1-watt resistor located in the can

MAJESTIC 116 Auto Radio

Inoperative	1)	faulty resistor across plates of rectifier
	2)	shorted spark gap. Remove and clean
Weak reception (after exposure to extremely humid or wet conditions)	1)	place entire receiver in warm oven for few hours to drive out dampness. Leave cover off. Be careful that oven temperature is not hot enough to melt any of the sealing compound
Weak reception (checks O.K.)	1)	replace G58AS tube in 2nd i-f amplifier stage with a 78 tube

MAJESTIC 118

Distortion	1)	replace tubular 10-mfd. condenser
	2)	check 0.03-mfd. audio coupling condenser
Weak reception (all voltages normal)	1)	replace the G58AS tube in the second i-f stage with a '78 tube
Noisy reception	1)	short-circuited 1-mfd. vibrator buffer condenser. Replace with new unit
	2)	poor terminal connections or short-circuited 0.008-mfd. vibrator transformer secondary buffer condenser. Replace with new unit

MAJESTIC 120B (Air Cell Receiver)

Fading, Intermittent reception	1)	faulty by-pass condenser in coil shield cans

MAJESTIC "130"-Series Receivers

Inoperative	1)	terminal lugs of push-pull input transformer "shorting" to core beneath the terminal strip
	2)	secondary winding of output transformer "shorted" to the electrostatic shield between the prim. and sec. Remove grounded lead from same, for a temporary repair
	3)	check for "short" in 0.3-mfd. 400-volt condenser, by-passing plate supply of first and second r-f stages
	4)	check 4,875-ohm 10-watt resistor in this circuit for decrease of value
Inoperative, (high cathode voltage on 1st and 2nd r-f tubes)	1)	blue wire torn away from volume control

(Cont'd)

MAJESTIC "130"-Series Receivers—(*Cont'd*)

Fading, Intermittent reception, Weak reception	1)	leaky or open-circuited 0.04-mfd. first r-f, second r-f, and detector secondary-return by-pass condensers. Use only finest grade replacements
	2)	terminal lugs of push-pull input transformer shorting to core
	3)	leaky or open-circuiting r-f screen by-pass condensers
	4)	leaky or open-circuiting r-f cathode by-pass condensers
	5)	replace all three 0.04-mfd. condensers used to couple the band-pass tuner units. They are mounted on the tuning gang condenser support. The r-f unit must be removed to replace them
Audio whistles, Squealing, Birdies	1)	connect a 0.006-mfd. condenser from plate to screen of pentode
Noisy tuning	1)	corroded copper friction contact on rotor of condenser gang. Solder flexible pigtails between rotor and condenser frame

MAJESTIC 130-A

See also the Case Histories listed under Majestic "130"-Series Receivers

Inoperative	1)	"shorted" 0.002-mfd. 400-volt detector plate by-pass condenser
Intermittent reception	1)	check all r-f by-pass condensers
Fading	1)	faulty 0.04-mfd. cond. by-passing 500-ohm resistor between sec. of last r-f transf. and chassis. Located under tuning cond.—remove tuning cond. shield to reach it
Low volume, Plate and screen voltages low, 4,875-ohm wirewound resistor overheats, (enamel peels)	1)	short-circuited 0.3-mfd. plate by-pass condenser in the i-f or r-f plate circuits. Test for defective units and replace wherever necessary
Whistling between 550 and 950 kc, (voltages and components check O.K.)	1)	remove the 0.04-mfd. condenser in the grid circuit of the first r-f tube. Set will operate better without it
Squealing or whistling (either all over or part of the tuning dial)	1) 2)	high-resistance tuning condenser rotor contacts. Solder flexible wire pigtails between rotors and condenser frame insert a 250,000-ohm, 1-watt resistor in series with the first r-f tube screen-grid. *Note*: do not by-pass this resistor to chassis
Poor tone, Loss of volume, (tubes and voltages check O.K.)	1)	open-circuited speaker field coil. An analyzer will usually not reveal this fault if tests are made from the chassis
Motorboating sound	1)	partially open 0.04-mfd. by-pass condenser (*No. 950*) connected across the third r-f screen-grid socket terminal and ground, (it is located on the r-f coil partition—near the front)

(Cont'd)

MAJESTIC 130-A—*(Cont'd)*

Improving performance of receiver	1)	remove the three 24 tubes toward rear of chassis and replace them with 35 tubes instead. The forward tube should be a '24 type. On the resistor panel, change the 7,900 unit to a 6,000-ohm 1-watt unit. Change the volume control to a 5,000-ohm wire-wound unit with right-hand taper. Disconnect cathode of third r-f tube from 154-ohm resistor and connect it to arm of volume control. Realign gang condenser. Remove "local-distance" switch and install a 2-megohm carbon left-hand taper in its place (center contact goes to chassis; left contact goes to a 0.002-mfd. mica condenser and then to the plate terminal of the audio transformer. The 1-megohm resistor mounted on the adjacent can is cut off entirely

MAJESTIC 131, 132

Same Case Histories as those listed under Majestic "130"-Series Receivers

MAJESTIC 151, 153

Inoperative, Weak reception, Noisy	1)	if antenna coupler is charred or burned out due to connecting the ground to the *ANT* post, a replacement may be used or a new coil may be wound. Use about 50 turns or more of No. 30 single cotton-covered wire

MAJESTIC 160, 163

Same Case Histories as those listed for Majestic 35 and 60 Series

MAJESTIC 181

No reception	1)	"shorted" filter cond. in power pack
Intermittent reception, Inoperative	1)	open-circuited bias resistors in r-f, first audio or power stages
	2)	loose terminals on power pack terminal strip. Tighten all nuts securely
Fading	1)	loose power-pack terminal-strip nuts
Cond. cable broken	1)	remove gang assembly to restring. Use violin "D" string—or 24-pound fish line for restringing
Indistinct reproduction	1)	repair seam on speaker cone

MAJESTIC 194

Inoperative (with pinkish glow in rectifier)	1)	high voltage arcs over to chassis from tube prongs of rectifier due to small chassis cutout for socket. Arcing causes socket to carbonize, necessitating replacement. Before removing damaged unit, make six pencil marks around circumference of socket hole (one opposite each prong hole of socket). Then remove socket, making note when unsoldering leads as to what terminals they came from. Now, with a tapered-blade hack-saw, cut out notches around circumference of hole at points marked with pencil. Make notches sufficiently deep and wide so that when new socket is installed there will be ample clearance between tube prongs and chassis to prevent repetition of trouble. The job can be made neat if the notches are rounded with a small rat-tail file

(Cont'd)

MAJESTIC 194—*(Cont'd)*

Distortion	1)	check for "open" or "decreased capacity" electrolytic filter condenser in block
Hum, Whistling or squealing	1)	"open" section in 6-4 mfd. electrolytic condenser block

MAJESTIC 195

Same Case Histories as those listed for Majestic 55 and Majestic 59 receivers

MAJESTIC 200

Poor reception, Poor tone, Weak	1)	change in value of *R1*, a 15,000-ohm resistor and *R2*, a 20,000-ohm resistor (both part of the voltage-divider system) connected respectively between the plate and screen circuits, and screen circuits and cathode coil. Replace with 10-watt units
	2)	leaky condensers in can containing the 0.03-mfd. coupling condenser *C5*, the 0.1-mfd. first detector cathode by-pass condenser *C4* and the 0.25-mfd. r-f cathode by-pass condenser *C3*. Replace the entire can, either as a unit or with individual units
	3)	check '35 or '51 tube in first-detector socket. Try replacing with a '24A (G51's and G35's may be rpelaced with G24's)
Fading intermittently	1)	check for intermittently "open" avc condenser located on top of one of the shielded coils
Regenerative whistles	1)	ungrounded shielding on one of the '51 spray-shielded tubes. Connection to the shield may be made by wrapping a few turns of fine bare wire around the envelope and grounding to the cathode prong
Noisy reception (all voltages check O.K.)	1)	high-resistance in the first i-f transformer plate circuit. Check with ohmmeter and replace unit if necessary

MAJESTIC 201

Whistling or squealing	1)	bolt holding speaker to baffle extends too near spray shield of first r-f '35 tube. Cut off the bolt as short as possible

MAJESTIC 210

Inoperative	1)	faulty electrolytic condenser, replace both condensers
Lack of sensitivity	1)	check '31 or '51 tube in first-detector socket. Try replacing with a '24A tube (G51's and G35's may be replaced with G24's)
	2)	replace type '27 first audio tube with type '56
	3)	check 100,000 ohm detector grid leak for excessive change in value. Replace
Distortion	1)	try a new tube in oscillator socket
	2)	try a new 100,000-ohm detector grid leak

MAJESTIC 230

Weak reception	1)	check for "open" 500-ohm 1/10-watt resistor in grid circuit of 24 detector tube (connected from grid-return lead of tuning coil to ground). This resistor is located inside of coil shield, alongside the coil. Replace

MAJESTIC 233

Same Case Histories as those listed for Majestic 130, 131, 132

MAJESTIC 290

Volume cannot be reduced to comfortable level	1)	faulty, "opening" 10-mfd. condenser from cathode of '57 tube to plate of '58 noise-suppressor tube
Distortion (only when volume control is advanced)	1)	leaky audio coupling condensers (*C10* or *C20*)
	2)	leakage between the 7 and 10-mfd. electrolyitc condensers which are in the same case. Connect another 10-mfd. condenser externally to the case after cutting the other one out. Be careful of polarity when connecting
Suppressor control inoperative	1)	"shorted" or "leaky" 10-mfd., 50-v. condenser *C8* from one end of volume control to cathode of G57 audio tube

MAJESTIC "300"-Series Receivers

Inoperative	1)	open-circuited center plate winding of pilot-light reactance transformer
	2)	check for "short" in 0.25-mfd. condenser which by-passes screen of G58S tube in r-f stage (this unit is part of the by-pass condenser pack having lug type terminals)
Blows fuses	1)	carbonized type '82 tube rectifier socket
	2)	inoperative type '82 tubes (not burnt-out)
Weak reception only at critical points of volume control setting, Low volume	1)	high-resistance leak from the 0.1-mfd. condenser contained in can marked "C" and "D" and connected from the volume control to the control-grid of the r-f and i-f tubes to ground or to other 0.25-mfd. condenser contained in the same can. Ohmmeter will not detect either of these leaks. Cut both leads coming out from holes of can and replace with a good 0.1-mfd. unit
	2)	check each ⅛-watt carbon resistor for more than 25% change in value
Low volume, Whistling, Squealing	1)	open-circuited 0.1-mfd. condenser in plate circuit of push-pull detector
Fading soon after set is switched on	1)	replace 0.25-mfd. condenser contained in can described in (1) directly above. One side (red lead) of this condenser is grounded
	2)	check for faulty ½-megohm resistor connected between cathode and suppressor of G57S tube in first a-f stage
Tuning light inoperative	1)	check for "shorted" 20-mfd. low-voltage electrolytic condenser shunted across center winding of reactance transformer. Also note voltage rating of tuning light bulb being used (it should be 2.5V.)
Poor tone, Distortion	1)	dual speakers out of phase. Reverse voice-coil connection in one of them
	2)	high-resistance leak in coupling condenser connected to tube side of volume control
Weak reception (volume controlled on only about 1/5 of the manual volume control)	1)	replace 57 tube (directly above the manual volume control) with a shielded type 58S tube

(Cont'd)

MAJESTIC "300" Series Receivers—*(Cont'd)*

Noisy reception	1)	change position of type '82 tube rectifier high-voltage and filament leads
Whistling, Squealing Low volume	1)	"open" 0.1-mfd. cond. *C10* in plate circuit of push-pull detector
Hum (diminishes as tone control is turned to "bass" side)	1)	separate the switch leads from the tone-control leads (they are usually found cabled together). Twist the two tone-control leads together to diminish inductive effect
Motorboating sound (when volume control is advanced)	1)	check the 10-mfd. electrolytic condenser
Distortion when volume control is advanced	1)	high-resistance "leak" in coupling condenser connecting to tube side of volume control
Replacing original tubes in i-f and r-f circuits with standard tubes	1)	apply shellac over glass of conventional tubes, then stick tin-foil over glass, forming a close-fitting shield. Twist a piece of bare copper wire over foil, just above tube base and attach to the cathode terminal of tube

MAJESTIC 300A

See also Case Histories listed under Majestic "300"-Series Receivers

Operates only on one-quarter turn of volume control	1)	faulty No. *C-17* condenser. Replace with 0.01-mfd. 400-volt unit
Weak reception (volume peaks at midpoint of volume control)	1)	replace the 0.1-mfd. condenser having the white rubber-covered leads and connected between one end of the volume control and the grid circuits of the r-f and i-f tubes. It is mounted in a square can
Reception chokes off immediately after set is turned on	1)	replace the 0.25-mfd. condenser found in the same can mentioned above (red lead, red side grounded)
Hum (diminishes as tone control is turned to the "bass" side)	1)	separate the switch leads from the tone-control leads (they are usually found cabled together). Twist the two control leads together to diminish inductive effect

MAJESTIC 303, 304, 307

See also Case Histories listed under Majestic "300"-Series Receivers

Inoperative (no plate voltage on r-f, 1st det., and i-f tubes)	1)	"open" center winding of the pilot-light reactance transformer in the plate-supply circuit of these stages
Line fuses blow frequently	1)	if filter condensers are not shorted, check '82 rectifier tube socket for carbonization produced by arcing across the contacts. As this carbonization is often between the two wafer sections of the socket it may not be readily visible. Check the socket for a "burned" odor

(Cont'd)

MAJESTIC 303, 304, 307—*(Cont'd)*

"Rushing," or "arcing" noise interference	1)	adjust noise-suppressor control for maximum sensitivity. Try moving the high-voltage and filament leads of the '82 mercury-vapor type rectifier apart (with an insulated object for safety against the high voltage) until the interference is reduced to minimum
Pilot light (resonance indicator does not dim upon station resonance)	1)	"leaky" or "shorted" 20-mfd. low-voltage electrolytic by-pass condenser connected across center leg or plate winding of reactance transformer
Highly distorted, Weak reception (Model 307 receiver)	1)	open-circuited or leaky 0.1-mfd. audio coupling condenser
Poor tone, Weak reception (Model 307 receiver)	1)	inoperative type '58 phase-rotating tube (not burned out)

MAJESTIC 310-A

See also Case Histories listed under Majestic "300"-Series Receivers

Intermittent reception	1)	high-resistance connection between poorly cleaned enameled voice-coil wire and leads
Poor sensitivity	1)	place a 20,000- or 30,000-ohm resistor across the grid return of the i-f transformer and ground

MAJESTIC 310-B

See also Case Histories listed under Majestic "300" Series receivers

Inoperative, Blocking of signal	1)	slight leakage in 50-mmfd. plate feed condenser of avc causes the avc to be biased, killing reception. Replace with 100-mmfd. mica unit

MAJESTIC 320

Distortion on strong signals	1)	check 50,000-ohm mounted inside of i-f transformer can for change in value. Replace

MAJESTIC 324

Same Case Histories as those listed for Majestic "300"-Series and Majestic 303, 304, 307 Receivers

MAJESTIC 330 CHASSIS

Inoperative	1)	check 10,000-ohm screen resistor of the i-f tube next to the '55 tube
Intermittent reception	2)	check i-f transformer windings for continuity, as expansion often breaks the windings. Replace any faulty units

MAJESTIC 344

Same Case Histories as those listed for Majestic "300"-Series and Majestic 303, 304, 307 Receivers

MAJESTIC 363

Same Case Histories as those listed for Majestic "300"-Series and Majestic 303, 304, 307 Receivers

MAJESTIC 370

See also Case Histories listed under Majestic "300"-Series Receivers

No local reception with grid cap off i-f tube	1)	i-f coil "shorted" to case. Remove it from case, bend back the lug and put insulating paper between coil and case
Poor tone quality	1)	replace filter condenser block as some condensers have lost capacity

MAJESTIC 371

See also Case Histories listed under Majestic "300"-Series Receivers

Inoperative after half hour of operation	1)	expansion of field poles due to temperature use, causing voice coil to stick. Replace speaker with one of better design

MAJESTIC 380

See also Case Histories listed under Majestic "300"-Series Receivers

Inoperative, Weak reception	1)	"open" or "shorted" audio by-pass condenser in 3-section unit (capacities of three condensers in this unit are 0.01-mfd., 0.03-mfd. and 500-mmfd.). Replace
Weak reception, Hum	1)	check the G57AS and G58AS tubes. (These tubes have 6.3-volt, 0.4-amp. filaments and cannot be replaced with G57S or G58S type tubes)
"Cuts out" and whistles or squeals	1)	some sets came through from factory with a '58 tube in r-f socket instead of a G58A. Replace with a G58A (has a 6.3-volt heater)

MAJESTIC 381

See also Case Histories listed under Majestic "300"-Series Receivers

Inoperative	1)	if ohmmeter applied between filament of G84 rectifier and chassis indicates full scale, the 8-mfd. section of the 8-4 mfd. electrolytic condenser block is "shorted"
Weak reception, Poor selectivity	1)	remove the metal shield from the bottom of the chassis. Use the volume control to keep oscillation under control
Improving reception	1)	replace the 50,000-ohm resistor (located on, and across, the filter condensers) with a 25,000-ohm unit

MAJESTIC "400"-Series Receivers

Low volume, (r-f pickup O.K.)	1)	open-circuited speaker field coil. Remove coil, wrap it with fish paper and replace
No signal from type '57A detector-oscillator tube, (i-f and other tubes O.K.)	1)	grounded i-f transformer. (There should be no reading from control-grid of i-f '58A tube to transformer can.) Remove coil from can, wrap with fish paper and replace
Set dead from grid of type '43 output tube on	1)	open-circuited C-bias resistor in cathode circuit. Replace with 700-ohm unit
Excessive hum	1)	short-circuited electrolytic condenser across type '43 tube bias resistor
To improve reception	1)	replace the 0.05-mfd. condenser across the line with a 0.1-mfd. size

MAJESTIC 400

See also Case Histories listed under Majestic "400"-Series Receivers

Inoperative at certain points on dial	1)	oscillator tube stops functioning. Try interchanging tubes
	2)	replace the 250-ohm oscillator bias resistor with a 160-ohm unit. Replace the 2,000-ohm unit in series with it with a 2,500-ohm unit
Weak reception	1)	"open" speaker field. The break may be at the end of field winding, so unwind a few turns before deciding to install a new coil
Tunable hum	1)	"open" antenna coil or grid lead to first tube. Shunt the line with a 0.1-mfd. by-pass condenser at the "on-off" switch

MAJESTIC "400-A" Series Receivers

Hum of the "gurgling" variety	1)	faulty type 6D7 detector tube (even though it tests O.K.). Determine best tube by substitution
Intermittent reception	1)	loose filament in type 46A or type 46B ballast tube. Test by tapping tubes

MAJESTIC 411, 413

See also Case Histories listed under Majestic "400"-Series Receivers

Inoperative over a part of broadcast band	1)	'57 first detector-oscillator tube does not oscillate over the entire band. Try several new tubes until a satisfactory one is found. Another remedy is to change the 250- and 2,000-ohm carbon resistors in the cathode circuit of the '57 tube to 150 ohms and 2,500 ohms, respectively
To improve reception	1)	replace the 0.05-mfd. condenser across the line with a 0.1-mfd. size

MAJESTIC 440

See also Case Histories listed for Majestic 194 and Majestic "400"-Series Receivers

Inoperative on all bands, Inoperative over part of dial	1)	failure of oscillator to work properly. Check for a poorly soldered joint at the third grid return 150,000-ohm resistor associated with the 6A7 tube
Inoperative, (high plate voltage on all tubes)	1)	500-ohm cathode resistor for the '41 tube "open"
Blows fuse	1)	replace the 6Z5 rectifier with a 6Y5 type tube and connect a 0.1-mfd. condenser across the other side of the a-c power line (there is already one connected to one side of the line). Then remove chassis and replace fuse
Intermittent reception, Noisy	1)	faulty 6F7-S tube
	2)	noisy tubes in the receiver

(Cont'd)

MAJESTIC 440—*(Cont'd)*

Whistling or squealing	1)	faulty 6F7 tube (which is critical in this receiver)
	2)	"open" in the common connection of condensers *C2, C3, C5, C7, C14* (all of which are encased in a single metal can just under the loudspeaker). Replace with individual tubular condensers
Motorboating sound	1)	"open" 1-megohm resistor located in the grid return of the '6F7 triode section

MAJESTIC 460

Inoperative (high plate voltage on all tubes)	1)	"open" 500-ohm resistor in cathode circuit of '41 tube
Inoperative all over dial, Inoperative over part of dial	1)	due to failure of oscillator to operate properly. Check for a poorly soldered joint at the third grid return 150,000-ohm resistor associated with the 6A7 tube
Inoperative, Howling	1)	low leakage path between the cathode and grid *No. 1* of the type '2A7 tube. Replace the 0.1-megohm resistor in this circuit
	2)	open-circuited plate windings in the second i-f coil
	3)	replace volume control with a 250,000-ohm unit
Whistling or squealing	1)	faulty 6F7 tube (this tube is critical in this set)
Steady motorboating sound	1)	"open" 1-megohm resistor located in grid return of 6F7 triode section
Intermittent motorboating sound	1)	short-circuited turns in the diode winding of the second i-f transformer
Noisy reception with antenna and ground terminals short-circuited, Insensitive, Poor selectivity	1)	faulty i-f transformer, making it impossible to peak that particular circuit. Replace with new unit

MAJESTIC 460A

Inoperative, Motorboating sound	1)	high-resistance connection between the grid lead of the '58 i-f tube and the lug on the i-f transformer
	2)	high-resistance leakage between prim. and sec. of third i-f transformer

MAJESTIC 461

Audio howl at certain settings of volume control	1)	replace the volume control with a 250,-ohm unit

MAJESTIC 461A

Intermittent operation and distortion when operated with volume control at "high" position, signal disappearing after a time at "low" volume setting	1)	faulty 0.03-mfd. coupling condenser (in a block) connected from the moving arm of the volume control potentiometer to the control-grid of the '55 tube. Install a new single-unit condenser externally

MAJESTIC 463

Audio howl at certain settings of volume control	1)	replace volume control with a 250,000-ohm unit

MAJESTIC 490, 491, 493

Type 6Y5 tube burns out	1)	short-circuited condenser *C-15* (usually occurs when set is used in damp place). Replace with good quality condenser
Fuses blow persistently	1) 2) 3)	short-circuited type 6Y5 tube short-circuited filter condenser defective vibrator
Inoperative when voltage drops	1) 2)	defective type 6Y5 tube defective type 6A7 tube
Stations come in at two points on dial, Distortion	1)	"open" AVC section of second-i-f transformer
Audio howl at certain settings of the volume control	1)	replace the volume control with a 250,000-ohm unit

MAJESTIC 500

Inoperative over part of dial	1)	replace the small 50,000-ohm oscillator grid leak connected from cathode to grid of the 6A7 tube. This resistor often increases greatly in value
Inoperative when nearby house light is turned on	1)	short out the AVC 300,000-ohm resistor in the grid-return circuit of the 6A7 tube. The trouble is caused by overbiasing of the 6A7 by the surge, paralyzing its operation
Inoperative (nothing coming through tubes ahead of the '42 tube)	1)	check for an open 0.05-mfd. tubular type condenser going from the triode plate of the 6F7 to the control-grid of the '42
Motorboating sound (all voltages check O.K.)	1)	"short" between the primary and secondary windings of the third i-f transformer. Replace the unit
Motorboating sound when tuned off resonance	1)	0.25-mfd. by-pass condensers on 6A7 and 6F7 cathodes need replacement. (These are in the container containing four 0.25-mfd., one 0.06-mfd. and one 0.03-mfd. units)
Selectivity poor	1)	drill a hole in the top of the second i-f transformer case (being careful not to damage the parts inside). Mount a balancing condenser in this position, connecting it across the transformer primary. Adjust it for maximum selectivity

MAJESTIC 500A

Inoperative (no voltages)	1)	"shorted" small condenser inside i-f can. The small 1/5-watt resistor associated with it is probably damaged also and should be replaced

MAJESTIC 520

See also Case Histories listed for Majestic 95 receiver

"Cutting off"	1)	cut the *white* lead from 67.5 to 135 volts. Late productions of this model already have this change made

MAJESTIC 560, 566

Same Case Histories as those listed for Majestic 55, 59

MAJESTIC 650

Noisy, Crackling	1)	poor connections in second i-f transformer. Solder all connections—or replace

MAJESTIC 800 CHASSIS

Low volume	1)	replace the second-detector socket with a six-prong unit and rewire for a type '55 tube, using the diode section as a diode detector and the triode section as a first a-f amplifier feeding the type '56 tube
All three dial lights burn out	1)	insulation on heater wires leading to travelling light assembly wears and permits wires to "short" to chassis. Use high grade flexible wire for replacement. Also check the **A-16037* ballast tube for possible damage

MAJESTIC 850

Weak reception	1)	faulty Hi-fidelity switch. Replace with a good S.P.D.T. rotary switch
Dial lights burn out	1)	insulation on heater wires leading to travelling light assembly wears and permits wires to "short" to chassis. Use high grade flexible wire for replacement

MAJESTIC 1250

Distortion when vol. control is set at low-volume position	1)	remove the audio coupling condenser which couples the 6F5 triode with the detector diode. It will be found between the volume control and diode return. Connect this condenser into the grid circuit of the tube instead—between the grid and volume control. Then connect a 2-megohm resistor from grid to ground

---

MANTOLA

MANTOLA 5Z

Weak reception, Distortion	1)	enamel-insulated lead going to inside of speaker field "grounds" thereby "shorting" out the bias produced by the 1800-ohm field. Remove field coil and insulate this lead

---

MARCONI *(CANADIAN)*

MARCONI *(CANADIAN)* 1930 "STANDARD", "JUNIOR", "SENIOR"

Inoperative, No signals, Low volume	1) 2)	receiver circuits out of alignment dirty variable resistor which tracks with the tuning condenser gang. Clean the resistor with graphite

MARCONI *(CANADIAN)* 27 Converter

Inoperative, Weak	1)	replace all the 0.1-mfd. plate by-pass condensers

MARCONI *(CANADIAN)* 35

"Crackling" noise, "Bubbling" sound	1)	high-resistance rotor contacts. Clean contacts and solder flexible pigtails between rotors and condenser frame
	2)	connect a direct "ground lead" to the tuning condenser section

---

MARCONIPHONE

MARCONIPHONE (U. S. A.)

Weak reception	1)	replace detector plate resistor

MIDWEST

MIDWEST 9-34

Noisy when volume control is at low-volume position	1)	faulty winding in push-pull input transformer

MIDWEST G-10

Replacing tubes	1)	when replacing tubes in this receiver, use a '58 in place of the '57. This will provide better operation

MIDWEST 11

Poor operation	1)	install a 0.05-mfd. condenser from the grid coil return to ground. Realign the receiver for increased gain. Replace the two ⅛-watt carbon resistors across the lugs of the speaker socket with a 1-watt unit (*orange* resistor is 3 megohms and *blue* resistor is 6 megohms
	2)	check the 0.1-mfd. condenser (connected from the common "ground" of the above resistors) for leakage

MIDWEST 11-36

Intermittent reception	1)	push back shielding on volume control leads so it does not touch the volume control terminals
Hum, Low volume, Distortion	1)	12-mfd. electrolytic cathode by-pass condensers for the first-audio and driver stages have reduced in capacity due to heat, etc. Test by shunting them with 25-mfd., 25-v. units to see if hum disappears

MIDWEST 12

Excessive hum	1)	open-circuited 5-mfd. condenser in the cathode circuit of the type '58 second a-f tube. Replace with new unit
	2)	lug on power transformer "grounding" to bolt on it. This lug is connected to the shield which shields the lead from the secondary of the last i-f transformer to the volume control. Ground this lug to the chassis

MIDWEST 16-34

Poor selectivity, Weak reception	1)	receiver circuits do not hold their alignment, due to shifting of windings on coils. Coat all coils with wax or liquid cement and realign the circuits. Go over all the trimmers a number of times to uncover interaction between the circuits. Before realigning, install a 3- or 4-plate variable midget condenser in place of the tone control assembly (the tone control assembly can be mounted on the side of the cabinet). Connect this midget condenser in parallel with the adjustable coupling condenser between the oscillator circuit and the mixer grid. Since this condenser affects the tuning

(Cont'd)

MIDWEST 16-34—*(Cont'd)*

Poor selectivity, Weak reception —(*Cont'd*)		of the various bands, by having it variable from the outside, the efficiency can be greatly increased. When aligning the receiver at 450-kc, have this newly-installed condenser set at about ¼-mesh and screw the adjustable coupling condenser to "minimum"
Unstable operation	1)	go over with a soldering iron all the grounded joints of the shielded cables, condenser frames, three coil and trimmer frames, etc. Do not depend upon rivets for good contact. Realign the receiver
Distortion at resonance	1)	AVC i-f transformer out of alignment
Poor tone (especially on phono reproduction)	1)	replace the cathode by-pass condensers on all the audio tubes with 5-mfd., 25-volt units
Noisy reception (sounds like tearing cloth)	1)	short-circuited trimmer condenser under the chassis. Replace with new unit
Type '82 tube flashes	1)	two short-circuited 8-mfd. filter condensers

MIDWEST 16-35

Inoperative (completely) (low or no voltage on 6D6 oscillator plate)	1)	check for "shorted" 0.002-mfd. mica 6D6 oscillator plate and screen by-pass condenser
	2)	check for "shorted" condensers in the 2A5 driver tube cathode circuit
Inoperative on high-frequencies	1)	try replacing the oscillator tube
	2)	if a buzzing noise is audible from the vibrator pack, or when the volume control is turned down, tighten the screw which holds the vibrator pack in the housing. This is located at the bottom of the set and also holds the cover of the set on. Poor grounding of the vibrator causes the trouble
Weak reception, (with distortion on strong local signals) Dimmer pilot lights operates in reverse when using sensitivity control on locals	1)	too much AVC voltage being applied to second i-f stage. AVC lead connects to high side of diode load resistor on 6B7 tube. Disconnect this lead and connect it to tap on diode load resistor—the same tap supplying AVC voltage to the first i-f stage
Distortion at upper range of volume control	1)	broken lead on 0.1-mfd. condenser connected from plate of 76 first audio tube to tone control
Distortion at resonance	1)	realign the i-f transformer located between the 76 and 6B7 tubes

MIDWEST 17-39

Weak reception, Distortion (accompanied by red glow on plates of 6J5G driver tubes)	1)	check for "shorted" 0.1-mfd. 400-volt audio coupling condenser. Replace with 0.02-mfd. 600-volt units

MIDWEST 17-40

Whistling or squealing when tone buttons are pressed	1)	connect a 0.0001 to 0.0005-mfd. 400-volt by-pass condenser from plate of first a-f tube to ground. This acts as a by-pass condenser in parallel with the "alto" and "tenor" tone control condensers
Improvement in early-production receivers	1)	connect a 20-mfd. 25-volt electrolytic by-pass condenser between cathode and ground of the 6P5 inverter tube

MIDWEST 18-35

Weak reception	1)	excessive leakage in 0.05-mfd. 400-volt bypass condensers inside i-f cans. Also check 5,000-ohm ¼-watt decoupling resistors for damage due to overheating caused by the condenser leakage

MIDWEST 18-36

Periodic fading	1)	faulty "open-circuiting" 75-mmfd. mica condenser (located inside of last i-f coil) connected in parallel with the secondary trimmer of this coil. This detunes the i-f stage
"Buzzing" on the deep bass notes	1)	fatigue of the speaker cone and voice coil form, causing the voice coil to lose its trueness momentarily resulting in its rubbing against the pole-piece. This defect can only be detected by removing the field coil and housing, and observing how badly the voice coil sags when the cone is pressed downward. First, make sure that the voice coil is properly centered. Then, having the correct speaker shims in place between the voice coil and center magnet, apply several coats of speaker cement to the cone, front and rear for about 3 or 4 inches starting at the voice coil, allowing each application to dry thoroughly with the shims in place

MIDWEST 20-38 AC

Inoperative, Intermittent, Noisy	1)	check wiring to dial light and bull's eye. If worn or broken, replace with stranded wire having better insulation

MISSION-BELL

MISSION BELL 17A

Inoperative (KR1 rectifier does not light up)	1)	mercury in the rectifier tube "shorts" the elements. Place the tube in a tester, and apply 6 volts d-c to its filament

MOHAWK RECEIVERS

(These Case Histories are listed under ALL-AMERICAN MOHAWK)

MONTGOMERY WARD RECEIVERS

(These Case Histories are listed under AIRLINE)

MOTOROLA

MOTOROLA 1935, 1936 Models

Jumps station on bumpy road	1)	remove chassis from receiver case. Reset drive gear and tighten

MOTOROLA 1941 Wireless Record Player-Changer

Continues to cycle	1)	in a few cases, when a changer goes through repeated cycles, instead of playing the records, the fault is due to too close an adjustment of the oscillating switch. You can always identify this trouble, however, by the "click" of the magnet, which indicates that the switch is making contact A more frequent condition is one wherein the pawl on the die cast cam wheel pushes the armature aside and rides on by it instead of being lifted by the armature at the end of a cycle, as it should be. It has been found that this is caused by too much load on the pawl. That is, the pawl has to push too hard against the big gear, because there is too much friction in the cam. This friction has been reduced by removing the tension washer from under the cam wheel, and substituting instead a thin spacer washer, part *No. 4A21491*. To make this change, first remove the long drive belt and then the large die cast pulley, exposing the cam wheel underneath it. Then remove the entire cam assembly by taking out the large screw which mounts it to the base plate, being careful that you do not disturb the relay or bend the switch leaves. Next remove the "C" washer and dismantle the cam assembly. When you put it back together, leave out the tension washer and substitute instead the spacer washer (*4A21491*).
Relay adjustment	1)	the relay is adjustable because one of its mounting holes is elongated. When the two Phillips screws, which hold it to the base plate, are loosened, the relay may be moved back and forth over an arc of several degrees. Set the relay at the point where it positively disengages the pawl at the end of the cycle and tighten the Phillips screws. Note: Originally the relay adjustment was made with consideration to the setting of the secondary or "circuit breaker" switch. This method, however, results in a compromise between proper adjustment of both units and is no longer followed in the factory. See following paragraphs.
Secondary switch	1)	the "secondary" or "circuit-breaker" switch is not absolutely essential to the operation of the record changer, and could be dispensed with by the simple expedient of short-circuiting it. Its purpose is to reduce the length of time the relay remains energized, during which period it buzzes—a condition inherent in a-c relays. However, unless the relay "buzz" is extremely subdued, the secondary switch should be retained in the circuit. You must, however, make sure that it is operating properly. To function as it should, the circuit breaker should be closed when the Changer is not cycling. (When a record is being played.) The switch is closed when the insulator is riding on the cam. (See Fig. 3 in Record Changer Service Manual.) If the adjustment of the relay (to assure positive disengagement of the pawl), causes the cam to stop at a point where the circuit breaker has fallen off the step, (or is dangerously near the edge), then remove the circuit breaker switch from its mounting bracket and remount it one hole farther forward, using only one mounting screw. The above procedure will assure the circuit breaker remaining closed until the cycle has positively started. It will eliminate all possibility that the cycle will fail to start when the needle is oscillating back and forth in the oscillating groove in the record.
Multiple "clicks"	1)	two or more "clicks" occurring at the start of an automatic change cycle are not to be considered a defect, although a single "click" of the relay is preferable. Whether the relay "clicks" once or twice depends as much on the record as it does on the adjustment of the Changer. A fairly close setting of the oscillating switch is desirable because it means a longer period of contact, but it must not be set so close that warpage in the record or a slight wobble in the turntable will cause it to make contact. Contact should be made only when the needle is in the oscillating groove. Records can account for double "clicks" because of variations in oscillating grooves. (The RMA is attempting to get all record manufacturers together on a set of standards, because these variations which occur in lead-in grooves, oscillating grooves, thickness, etc., have been a problem to all manufacturers of Record Changing equipment).

(Cont'd over)

MOTOROLA 1941 Wireless Record Player-Changer—*(Cont'd)*

"Positive" operation	1)	the changes in adjustment procedure outlined in the foregoing paragraphs, have resulted in positive-operation of the Record Changer. Properly made in the field, they will enable you to solve any service problems which may confront you.
Caution against moving tone arm	1)	you are cautioned against moving the tone arm except when it is "out of cycle." To do so, may result in improper indexing (failure to land the needle in the first groove). This simple precaution is necessary with practically all Record Changing equipment on the market.
Lubrication	1)	the importance of proper lubrication in the Motorola Record Changer cannot be stressed too strongly. Whenever a unit is serviced, no matter for what reason, its moving parts should be relubricated. "Just any old grease" is not good enough. The average lubricant will wear out after a short period of service. Record Changer grease should be used at the following points: (1) Turntable Bushing, (2) Idler Pulley Shaft, (3) Large Drive Pulley. Order *No. 11M8952* Motorola Record Changer Lubricant. Use a light oil, such as "3-in-1," for the following items: (1) Pick-up Elevating Pin, (2) Record Release Pin, (3) Fulcrum Block.

MOTOROLA "GOLDEN VOICE" Auto Radios

(See also Case Histories listed under Motorola 8-80 Golden Voice (1938) receiver

Inoperative, Intermittent reception, Low volume	1)	"open" voice coil in loudspeaker
	2)	low battery voltage being delivered to the receiver. Check all wiring and connections between the car battery and the receiver
	3)	the 'OZ-4 rectifier fails to start when the supply falls below 5½ volts, as it requires 15 ma. or more of drain to produce ionization. Replace the 'OZ-4 tube with a '6X5 metal-filament type rectifier tube in extreme cases. Most receivers came through with the rectifier socket already wired for '6X5 tube filament supply. In this case, just plug the tube in. If the filament wiring has not been installed, invert the chassis and remove the cover from the "hash" compartment. Connect one filament terminal of the rectifier socket to "ground" right near the socket. Connect the other filament terminal to the 0.5-mfd. condenser end of the circuit within the "hash" compartment. This condenser is located next to the "A" filter choke
	4)	check the dual 0.0008-mfd. condenser located near bottom of OZ4 tube
Muffled tone, Distortion at low volume levels	1)	volume control open. Use 500,000-ohm potentiometer for replacement
Motor noise	1)	push the "acoustinator" plug all the way into its socket tightly
	2)	check the receiver for the possibility that water has gotten into it (if mounted under the engine hood), causing "corroded" grounds in both the receiver and the "eliminode" unit. Remove chassis from case, clean all corroded connections
Vibrator life short	1)	connect "A" lead of radio directly to storage battery terminal instead of to ammeter. This will reduce voltage applied to radio, and results in longer tube and vibrator life

MOTOROLA W2 R. C. Automatic Record Changer

Mechanism slow in starting, Motor gets hot	1)	lubrication required, oil thoroughly. See lubrication instructions which follow
	2)	check for abnormally low, or high, line voltage
	3)	check for damaged motor windings
Motor fails to run	1)	disconnect motor entirely from other wiring, and apply proper voltage directly to the two ends of its windings. If it fails to run, trouble in the motor winding is indicated
	2)	check motor rotor by turning the drive sleeve with finger and thumb. If it seems to bind slightly it can usually be corrected by lightly tapping the bottom bearing bridge. This will align the two self-aligning shaft bearings and allow rotor to turn freely
Squeaks or other noises during playing of records	1)	check oiling by comparing squeak with and without a load of records. If squeak is heard only with record stack in place, rub a little wax on the turntable spindle. If heard with or without records in place, lubricate mechanism as directed later
Changer noisy when in cycle	1)	check oiling
	2)	see if any part has come loose, or is bent and is rubbing against a moving part (such as the swivel guide arm against the cam gear)
Trips too soon, or before record has finished playing	1)	too little clearance between the trigger and the clutch lever assembly. To get more clearance, turn the adjusting screw about a half turn in a clockwise direction. The tone arm should trip on ¼" motion
Tone arm falls off record	1)	needle sits down too close to edge of records, not adjusted in far enough, or needle landing adjusting cam is reversed. Should contact lug on adjusting rod extension on the long side of cam
	2)	check pickup leader spring for looseness. More tension can be obtained by bending down lug
Tone arm sets down too far in	1)	adjusting rod binds and does not measure properly. If found to be bent, it should be straightened to correct shape so it operates freely
Needle lands properly on record but fails to move over into record groove	1)	pickup arm is normally impelled toward center of record by lead spring. Increase its tension slightly by bending the lug, to which it is attached, down against main plate
"Wow" in reproduction	1)	warped record
	2)	oil on idler wheels or inside rim of turntable
Record drops on one side only	1)	changer post bent out of perpendicular to main plate. Be careful not to bend other parts when straightening post
	2)	one selector set for 10" while playing 12" records
Changer continues cycling	1)	failure of lift to be drawn back out of engagement with cam gear. Check various rivets at which motion occurs, to find point where friction or binding is interfering with freedom of motion
	2)	make sure that trigger spring is not disconnected. Also, that approx. 1/64" max. clearance exists between trigger and clutch lever
	3)	check for sticking pawl

(Cont'd)

MOTOROLA W2 R. C. Automatic Record Changer—*(Cont'd)*

Record is driven but not heard, or heard weakly	1)	see that pickup cord is plugged in
	2)	check amplifier and speaker, and connections to them
	3)	check output of pickup cartridge with V.T. voltmeter. Average voltage at 1,000 cycles using an audio test record should be from 0.5 to 2.5 volts depending upon type of crystal cartridge used. If cartridge does not deliver sufficient output, remove it and replace
Lubrication	1)	changer should be lubricated once a year with about a dozen drops of a good light machine oil at each of the following 3 points which can all be reached from above, through holes in the mounting plate, as follows: (*a*) through hole marked *BH* (under turntable), drop the oil upon flat surface of cam. Oil will distribute itself to proper points (*b*) through hole marked *BE* (to left of pickup swivel post), see felt wick, and drop oil directly upon it (*c*) through hole marked *BD* (in front of pickup swivel post), see felt wick, and drop oil directly upon it

MOTOROLA 3A5

Repeated tube burn-outs	1)	remove the 1700-ohm resistor in the filament midpoint circuit of the 3S4 tube. Replace it with a 390-ohm ⅛-watt-10% and a 680-ohm-⅛-watt-10% resistor connected in series—with the 390-ohm unit connected to the filament midpoint. Connect the junction of these two resistors to the *positive* terminal of the tube filament

MOTOROLA 5T-71A

Low sensitivity	1)	"faulty" r-f coupling condenser
	2)	receiver circuits out of alignment
	3)	"faulty" coil
Poor tone	1)	"faulty" type '71A tube
	2)	"faulty" input choke
	3)	weak "B" batteries

MOTOROLA DUAL "6" (D6) Auto Radio

Inoperative (no *B* voltages)	1)	"shorted" in the condenser block (usually red lead to cathode of '84 tube
	2)	shorted condenser across plates of '84
	3)	broken "ground" wire on vibrator frame
Inoperative on high-frequencies	1)	try replacing the oscillator tube
	2)	if a buzzing noise is audible from the vibrator pack, or when the volume control is turned down, tighten the screw which holds the vibrator pack in the housing. This is located at the bottom of the set and also holds the cover of the set on. Poor grounding of the vibrator causes the trouble
Weak reception (almost no signal)	1)	replace '77 tube
	2)	diode sec. in i-f transf. "shorted"
	3)	"shorted" i-f trimmer condenser
	4)	"open" antenna primary coil
Poor tone	1)	faulty type '75 tube
	2)	faulty type '42 tube
	3)	faulty 500,000-ohm type '75 tube plate resistor. Replace with a new unit
Speaker rattle	1)	dirt or filings in speaker air-gap

(Cont'd)

MOTOROLA DUAL "6" (D6) Auto Radio—*(Cont'd)*

Buzzing noise frim vibrator pack, Vibrator "hash"	1)	tighten self-tapping screw in bottom of set which holds vibrator pack in its housing. This is located in the bottom of the set, and also holds the cover on
	2)	connect a 0.5-mfd. automotive-type condenser between the hot "A" lead at the terminal lug and the ground
Howling, Motorboating sound	1)	mechanical vibration set up by speaker causes tuning condenser plates to vibrate. Mount speaker in a separate housing

MOTOROLA SUPER "6" Auto Radio

Same Case Histories as those listed for Motorola 66 (Super "6") Auto Radio receiver

MOTOROLA 6T-12

Low sensitivity	1)	faulty r-f coupling condenser
Whistling	1)	poor condenser-wiper "grounds"
	2)	"faulty" cathode condenser
	3)	high-capacity r-f coupling condenser
Poor tone	1)	"faulty" type '112 tube
	2)	"faulty" input transformer
	3)	"faulty" 50-mfd. electrolytic condenser

MOTOROLA 7T-38

Low sensitivity	1)	receiver circuits out of alignment
	2)	"faulty" r-f coupling condenser
	3)	"faulty" r-f coil
	4)	no plate voltage
	5)	"shorted" plate by-pass condenser
	6)	"open" untuned r-f transformer ahead of '237 AVC and det. tube
Poor tone	1)	'38 last audio tube "faulty"
	2)	650-ohm bias resistor for '38 last audio tubes "faulty"

MOTOROLA 7T-47A

Low sensitivity	1)	receiver circuits out of alignment
	2)	"faulty" by-pass condenser
	3)	"faulty" coil
	4)	"faulty" tubes
Poor tone	1)	"faulty" last audio tube
	2)	"faulty" loudspeaker
	3)	"faulty" 10-mfd. electrolytic condenser (located in outer housing)
	4)	weak "B" batteries

MOTOROLA SUPER "8" Auto Radio

Same Case Histories as those listed for Motorola 88 Auto Radio receiver

MOTOROLA TWIN "8" (T8) Auto Radio

Inoperative, (over whole, or part of, tuning range due to failure of oscillator to oscillate)	1)	check the '77 autodyne oscillator circuit by tuning the variable condensers to the minimum position, and touching the oscillator stator plates. If a "click" is heard when touching them, and also when removing the finger, it indicates that the autodyne is operating properly. Also try this over region where set is "dead"
	2)	faulty '77 oscillator tube
	3)	faulty 10,000-ohm '77 oscillator tube bias resistor

(Cont'd over)

MOTOROLA TWIN "8" (T8) Auto Radio—*(Cont'd)*

Inoperative on high-frequencies	1)	try replacing the oscillator tube
	2)	if a buzzing noise is audible from the vibrator pack, or when the volume control is turned down, tighten the screw which holds the vibrator pack in the housing. This is located at the bottom of the set and also holds the cover of the set on. Poor grounding of the vibrator causes the trouble
Low sensitivity	1)	i-f amplifier out of alignment
	2)	short-circuited i-f trimmer condenser
	3)	faulty 30,000-ohm screen circuit resistor
Poor sensitivity at 550-kc	1)	faulty r-f plate choke
	2)	faulty 600-kc padder
Excess vibrator "hash," Buzzing noise from vibrator pack	1)	tighten self-tapping screw in bottom of set which holds pack in place
	2)	connect a 0.5-mfd. "automotive"-type condenser between the hot "A" lead (at the terminal lug) and "ground" (case of receiver)
Excessive hum	1)	unmatched 6A4 last audio tubes
	2)	improperly adjusted "Elkonodes"
	3)	high-resistance "A"-hot line or receiver "ground"
	4)	poor grounding of pw'r pack in housing
	5)	faulty type '84 tube
	6)	faulty filter condenser
Tone quality poor	1)	"faulty" 6A4 last audio tubes
	2)	"faulty" coupling condenser in first or second audio stage
	3)	100,000-ohm '37 first audio tube plate resistor "faulty"
	4)	75,000- or 30,000-ohm resistor in plate circuit ot '85 diode tube "faulty"

MOTOROLA 8-60 Auto Radio

Intermittent reception	1)	check for "shorting" of two 50-ohm resistors (connected to vibrator socket) to chassis
	2)	check by-pass condenser (Part *No. 8A4568*) for "shorting" to spark plate
Reception cuts out after receiver warms up	1)	check for change in value of 68,000-ohm ¼-watt resistor in oscillator coil can. Replace

MOTOROLA 8-70 Auto Radio

See also Case Histories listed for Motorola 8-80 Golden Voice (1938) Auto Radio

Squealing and "cutting out"	1)	replace 0.01-mfd. condenser and 100,000-ohm resistor in grid circuit of 6V7G (both parts are contained in one case)
Vibrator life comparatively short	1)	connect "A" lead of receiver directly to storage battery terminal instead of to ammeter. This results in reduced voltage applied to the receiver, with consequent longer life for both vibrator and tubes

MOTOROLA 8-80 GOLDEN VOICE (1938) Auto Radio

Hum (increasing as volume control is turned down)	1)	inductive hum pick-up by push-pull input transformer. Drill out rivets which fasten the transformer and rotate it to find position of minimum hum. Fasten it in this position with brackets
Hum ("A" line ripple)	1)	mount Acoustinator unit with insulated washers and machine screws so it is permanently *insulated* from the dash

MOTOROLA 9-44 Auto Radio

Weak reception	1)	if "Boost-A-Matic" aerial coupler is being used, be sure that control wire for tuning the aerial coil does not bind or is not broken, for then the aerial coil will not be tuned and the sensitivity of the receiver will be reduced

MOTOROLA 9-49 Auto Radio

See also Case Histories listed for Motorola 9-69 Auto Radio receiver

High-pitched whine	1)	rivet which grounds voice coil and speaker field to chassis not making good electrical contact. Solder a jumper wire from these circuits to chassis

MOTOROLA 9-69 Auto Radio

Cam does not release properly from condenser shaft	1)	replace latch release spring located beneath electric tuning assembly on the condenser shaft
Tuner motor does not run	1)	motor contacts in control head not closing. Open the control head and inspect the motor contacts. If the gap is too great, contact will not be made when the button is pressed. Adjust by bending carefully
	2)	poor contact at push-button plug. Inspect the contacts between the plug and the receptacle on the chassis
	3)	open circuit in motor. Check all connections to motor, and check motor winding for continuity
	4)	motor brushes not making contact. Check contact between brushes and commutator. Clean dirty commutator with carbon tetrachloride
	5)	low battery voltage. A weak or defective battery in the car would not deliver sufficient voltage to run the motor
	6)	flexible tuning shaft binds. Binding in the flexible tuning shaft places an additional load on the motor. If this load is too great, it will prevent the motor from turning the mechanism
	7)	magnet fails to release. If the magnet which has previously been energized, fails to release the latch bar for any reason, the motor cannot turn the mechanism
Automatic tuner mechanism runs sluggishly	1)	low battery voltage. A weak or defective battery will not deliver sufficient voltage to turn the motor at normal speed
	2)	high resistance contact in control head. High resistance at the push-button contacts will cause a voltage drop which will prevent the motor from turning at normal speed
	3)	poor contact between push-button plug and receptable. This will also result in voltage drop, and lessened motor power
	4)	binding in tuning shaft. Binding in the flexible tuning shaft will place an additional load on the motor which can slow it down considerably. Install tuning shaft with minimum amount of bending, and check alignment where the tuning shaft enters the receiver housing
	5)	gears not properly meshed. Check all gears in assembly for binding due to improper meshing
	6)	defective motor. Replace
Tuner motor fails to reverse	1)	reversing switch not properly adjusted
	2)	open circuit in motor. If one side of motor circuit is open, motor will run in one direction only
	3)	open magnet winding. An open magnet will not pull latch down; consequently will not cause motor switch to reverse
	4)	latch bar spring too tight. If the latch bars operate under too much tension the magnet may not be able to pull the latch down
Automatic tuner fails to retain original setting	1)	latch rings not locked securely. The locking screw must be pulled down securely, otherwise, the shock of the sudden stopping will tend to slide the rings away from the original setting
	2)	original setting not accurate. Resetting of magnets may be necessary after several days' use, during which time the mechanism goes through a "shaking down" process
	3)	electrical drift. This is usually the result of a great change in temperature. Automatic compensation is provided in the circuit to take care of the normal operating tempera-

(Cont'd)

MOTOROLA 9-69 Auto Radio—*(Cont'd)*

Automatic tuner fails to retain original setting (*Cont'd.*)

ture range. Before making original setting, turn the set on and permit it to play long enough to arrive at a constant operating temperature

In zero weather do not expect the set to tune "on the nose" until after a constant temperature has been reached. In severe cases of electrical drift occurring at normal operating temperature, change the compensating condenser

Impossible to set up stations

1) too much tension on locking levers. When the automatic locking screw is loose, the station rings should move freely. If the levers still hold the station rings partially locked, the screws which hold the levers in position should be loosened one-quarter to one-half turn
2) latch rings "out of range." If the loosened latch rings slip on the drum until the notch falls out of reach of the latch bar, they can be brought back to position by following exactly the "setting procedure" outlined elsewhere here
3) die cast rings "out of round." Install new rings
4) die cast hub expanded. This usually causes the two outside rings to bind. Can be corrected by filing hub

Tuner fails to stop at station

1) open magnet winding. Check for continuity and replace if necessary
2) magnet contact in control head not closing. Inspect contacts. Adjust or clean if necessary
3) latch bar defective. Inspect latch bar to make sure that it has not been damaged. Replace latch bar, if required
4) poor contact at push button plug. A poor contact here means a voltage drop which reduces the pulling power of the magnet
5) improper spacing of magnet. Check the spacing between the latch bar armature and the magnet pole. When the tip of the latch bar is seated all the way down in the notch in the latch ring, the armature should not quite touch the magnet pole. A hairline of light should be visible between them
6) latch rings not locked securely. If the latch rings are very loose, the motor will continue to turn the gang until the plates are completely meshed

Tuner latch bar sticks in notch

1) manual tuning shaft binds. Binding in the tuning control shaft causes the latch bar to press hard against one side of the notch and may prevent it from releasing as the magnet is de-energized
2) latch bar spring weak. Check latch bar tension spring to make sure it is pulling away from the magnet with sufficient force. Spring tension is adjustable
3) magnet contact in control head stuck. Check the magnet switch in the control head to make sure it breaks contact when pressure is released on the bottom. Check for "frozen" contact points, or for "sticking" button
4) armature rivet worn. There is a brass rivet at the tip of the armature, to prevent the armature freezing to the magnet. If this rivet is worn down, permitting the steel armature to actually touch the magnet pole, it may freeze in that position
5) burr on tip of latch. Latch tip should be smooth and shiny
6) binding in latch bearings. Latch must move freely but not sloppily
7) latch tips not centered on latch rings. Latch tips must not rub bakelite guide rings. The latch bar bearing shaft is adjustable
8) friction clutch too tight. A tension washer between the motor pinion and the brass pinion collar acts as a friction clutch to absorb the shock of stopping the motor quickly when a station is tuned. If the tension is too tight, the torque of the stopped motor will hold the latch bar tip in the notch
9) motor brushes too tight. Too much friction between the motor brushes and the commutator will cause the same thing

MOTOROLA S-10 Auto Radio

Light in Tun-A-Lite rises too high or not enough

1) change the value of the 7,500-ohm resistor between the B-plus and terminal *No. 2* of the Tun-A-Lite. To increase the column *reduce* the resistance; *increase* the resistance to lower it
2) aerial wire is too short. At least 75 feet is required
3) line voltage "low"
4) '83-V rectifier tube "weak"
5) '78 r-f tube "weak"

(Cont'd)

MOTOROLA S-10 Auto Radio—*(Cont'd)*

Inoperative (tubes do not light)

1) filament circuit in the remote control cable "open"
2) connection at the speaker plug "open"

Inoperative (amplifier tubes do not light)

1) contacts on the relay "open." Decrease the tension on the relay spring

Excessive hum

1) filter condenser faulty
2) cathode of the type '86 tube short-circuiting to the filament

MOTOROLA 10Y

Reception cuts out

1) replace 2,700-ohm bakelite-encased resistor

Noise on broadcast band

1) "open" primary winding in broadcast band r-f coil (the one with a 47,000-ohm resistor across it). Replace

MOTOROLA 12Y, 12-Y-1

Reception cuts out

1) replace 2,700-ohm bakelite-encased resistor

MOTOROLA 15-F, 20-P, 21-L, 22-S Auto Radios

Same Case Histories as those listed for Motorola 9-96 Auto Radio receiver

MOTOROLA 23 RC

Turntable revolves too fast

1) remove turntable; loop a small strip of very fine emery paper around motor bushing. Then turn motor on and let it run. Check speed frequently. A few thousands of an inch ground off diameter of motor bushing this way will reduce speed to proper value

MOTOROLA 24-K, 25-N Auto Radio Receiver

Same Case Histories as those listed for Motorola 9-96 Auto Radio Receiver

MOTOROLA 29-B Auto Radio

Intermittent reception

1) inspect bracket holding tuning condenser. Make sure that bracket does not touch volume control terminal lugs

Reception cuts out on low-frequency end of dial only

1) replace 6-mmfd. compensating condenser connected across 600-kc padder

Weak reception, Hissing

1) replace 1,000-ohm r-f stage cathode resistor, and 820-ohm resistor in cathode circuit of first i-f tube, with 400-ohm resistors. Realign the receiver

Dial cord comes off repeatedly

1) replace dial cord and put a drop of Duco household cement on top of push-buttons (or in back of celluloids) so that celluloids in push-buttons cannot slide up and hit dial pointer thereby knocking off dial cord

MOTOROLA 34 Auto Radio

Inoperative (no voltages)

1) "short" in the condenser block (usually *red* lead to cathode of 6Z4, or '84, rectifier tube)
2) "shorted" cond. across rectifier plates
3) "shorted" 0.007-mfd. plate-to-cathode (chassis) condenser in '42 last audio tube circuit

(Cont'd over)

MOTOROLA 34 Auto Radio—(*Cont'd*)

Inoperative over part of dial (due to failure of oscillator to operate over entire band)	1) 2)	"faulty" 10,000-ohm grid-bias resistor for '77 autodyne oscillator tube "faulty" '77 oscillator tube (even though it may test O.K.). Try new ones
Low sensitivity	1) 2) 3) 4)	short-circuited i-f trimmer condenser "faulty" type '77 or '78 tube i-f amplifier out of alignment open-circuited screen resistor
"Hash" interference	1)	improper "grounding" of wiping contacts against receiver housing
Noisy (similar to a "noisy" tube)	1)	tighten all i-f coil shields. They are fastened to the chassis with self-tapping screws
Poor tone	1) 2)	"faulty" speaker "faulty" 500,000-ohm resistors in plate and screen circuits of '75 diode tube

MOTOROLA 34K6, 34K7 Auto Radios

Same Case Histories as those listed for Motorola 9-69 Auto Radio receiver

MOTOROLA 44 Auto Radio

Inoperative when mounted	1)	this receiver is normally mounted on its side. If it goes dead in this position, try it in a vertical position. If this starts operation, check the load-delay relay. If it "clicks" repeatedly (chatter) it indicates that the car battery voltage is too low
	2)	if B-voltages are below normal, check the small condenser located in the same case as the r-f choke near the B-plus outlet
Inoperative, Hum (power supply unit hums but set does not play)	1)	"faulty" vibrator condensers. Take vibrator unit apart and find the two small, flat condensers on top of the reed unit (the reeds connect to the *red* and *green* rubber-covered wires). Remove these condensers and solder a 0.01-mfd., 1600-volt tubular unit externally to each lead, join the two together and "ground" the midpoint
Excessive hum (receiver operating)	1)	hum due to audio oscillation may be remedied by connecting a small r-f choke in series with "B"-plus output circuit from the synchronous vibrator. Connect a 0.01-mfd. 600-volt by-pass condenser between chassis and low-potential end of this choke
Poor tone	1)	"faulty" type 12A5 last audio tube (even though it may test O.K.). Replace by substitution
	2)	short-circuited 10-mfd. electrolytic 12A5 tube cathode by-pass condenser. Replace with new unit
	3)	"faulty" coupling condenser
	4)	"faulty" speaker
Insensitive, Poor tone	1)	"faulty" 250-ohm type '75 tube cathode by-pass resistor. Replace with a new unit. *Note*: in some of the early models, this resistor is a 500-ohm unit. If a 500-ohm unit is found, always replace it with a 250-ohm resistor
	2)	receiver circuits out of alignment
	3)	faulty antenna coil

(Cont'd)

MOTOROLA 44 Auto Radio—(*Cont'd*)

Noisy reception only when car is in motion or when set is jarred (tubes, voltages and components test O.K.)	1) 2)	loose "grounding" screw on one of the coil cans cold-soldered joint. Resolder connection

MOTOROLA 50 Auto Radio

Intermittent operation	1)	inspect the ground-return lead inside the vibrator for a loose or broken connection
High background noise at low-freq. end of dial	1)	antenna series padder condenser shorting internally due to metallic particles embedding into mica insulation

MOTOROLA G-54 Auto Radio

Inoperative below 700-kc.	1)	"faulty" '77 tube

MOTOROLA 55 Auto Radio

Inoperative, (no plate voltage)	1) 2) 3) 4)	short-circuited filter condenser "shorted" Elkonode point condenser short-circuited "hash-filter" condenser (mica type condenser) if tubes do not light and power supply is inoperative, check for open circuit in power switch
Low sensitivity	1) 2) 3)	receiver circuits out of alignment "faulty" antenna coil "faulty" i-f transformer coil
Elkonode unit short-lived	1)	to prolong its life, connect a 50,000-ohm resistor across output of replacement unit
Vibrator hash and mechanical rattle	1)	remove can enclosing vibrator and power transformer. Turn over and mount securely on chassis with self-threading screws. Replace vibrator and cover and reverse the "A" leads to correspond with battery polarity of car. Discard tin cover, but place rubber bands around pack before putting back into case
Excessive hum	1) 2)	"A" battery leads too long, or improperly connected hum due to audio oscillation may be remedied by connecting a small r-f choke in series with "B"-plus output circuit from the synchronous vibrator. Connect a 0.01-mfd. 600-volt by-pass condenser between chassis and low-potential end of this choke
Poor tone	1)	short-circuited 30-mfd. electrolytic condenser. Replace with new unit

MOTOROLA 57 Auto Radio

Loud background hum (no a-f response, and peculiar tone)	1)	"open" in the high-capacity low-voltage section of the electrolytic condenser block. Remove entire block (located beneath the output transf.) and replace

MOTOROLA 59T5 Auto Radio

Distortion, "Raspy" reception	1)	check for "leaky" 0.03-mfd. coupling condenser connected between 75 plate and 41 grid. Replace with 600-volt unit

MOTOROLA 60 Power Pack

The type 60 Power Pack may be used in Models 77-A-B, Super-6 and Model 44. It cannot be used in the Model 77. The type 60 Elkonode is replaceable with types 70-B and 80. With the type 80, a 0.01-mfd., 1600-volt condenser is used and this must be connected to the Elkonode socket properly. When replacing the Elkonode point condenser in the type 60 Elkonode, remove the 0.007-mfd. condenser from the inside of the Elkonode and replace with a 0.01-mfd., 1600-volt condenser.

MOTOROLA 60 Auto Radio Receiver

Inoperative	1)	faulty 6B5 tube
	2)	faulty '84 tube
Signal cuts in and out	1)	speaker field wires loose. Check the joints carefully
Sharp cut-off on each side of resonance during tuning, and slight distortion when tuned to exact resonance	1)	resistance of volume control has increased to several megohms, changing the time constant of the AVC and causing the receiver to block for a few seconds after tuning. Either replace the volume control, or shunt the faulty one with a 0.5-meg., ½-watt carbon unit
Intermittent operation	1)	"loose" or "broken" connection at ground-return lead inside vibrator
Distortion	1)	"shorted" condenser block
	2)	0.01-mfd. 600-volt tone condenser damaged by heat of power tube. Mount new one inside chassis

MOTOROLA 61 Auto Radio

Inoperative, ("BR" tube does not ionize)	1)	if "BR" rectifier tube does not glow, check 0.05-mfd. buffer condenser across secondary of power transf. for "open." *Caution*: Never remove the "BR" tube from its socket unless the radio is turned off
Receiver and Elkonode operate spasmodically	1)	if the "BR" rectifier tube does not glow, check for "shorted" 0.05-mfd. buffer condenser across secondary of power transf.
Inoperative over part of dial	1)	failure of oscillator to operate properly over full range due to "faulty" oscillator cathode resistor. Replace with a 5,000- to 8,000-ohm resistor. If necessary, resolder all oscillator circuit connections, including coil wires to terminal lugs and connecting leads
	2)	try several new tubes in the critical autodyne detector-oscillator circuit
Low sensitivity	1)	"faulty" i-f unit
	2)	receiver circuits not aligned properly
	3)	faulty '36 tubes
	4)	if plate voltages are low, check for faulty "BR" rectifier tube, faulty buffer condensers, faulty Elkonode
"Noisy" operation	1)	coil shield cans not properly grounded
	2)	voice coil lead broken
	3)	poor connection on chassis plug
	4)	faulty volume control
Hissing sound in background	1)	substitute a '36 type tube in the oscillator-modulator tube socket

MOTOROLA 62 Auto Radio

Same Case History for "Loud background hum" as that listed for Motorola 57

MOTOROLA 65 Auto Radio

Fuses blow	1)	faulty rectifier tube
	2)	faulty vibrator
Inoperative, Weak, Intermittent	1)	broken wires from grid of 6A7 tube to tuning condenser
	2)	check the dual 0.0008-mfd. condenser located near the bottom of the OZ4 tube
Intermittent reception, Low volume	1)	see the Case History listing for this same trouble under Motorola "Golden Voice" receiver
Distortion after warming up	1)	check for change in value of 22,000-ohm plate and screen voltage dropping resistors, and 300-ohm and 1,500-ohm resistors in 75 tube cathode circuit. Replace
Motor noise (especially when installed in a Ford V8)	1)	shield hot "A" lead connecting set to fuse block with double layer of copper shielding braid. Ground braid at receiver end only
Installation	1)	when installing this receiver, dress the A lead away from the right-hand breather screen to prevent interference from feeding directly through this screen into the antenna stage of the receiver (when such interference intensity is high)

MOTOROLA 66 (Super "6") Auto Radio

Intermittent reception	1)	pitted vibrator contact points. If points are not worn too far, trim them with an ignition file; otherwise, replace
Poor sensitivity	1)	faulty i-f transformer coil
	2)	faulty type '78 tube
	3)	faulty antenna coil
	4)	high cathode bias on type '78 i-f tube
Low volume	1)	speaker mounting bolt improperly "grounded"
	2)	plate voltage below normal
Poor tone	1)	faulty power tube
	2)	faulty tone control condenser
	3)	grounded tone control
	4)	faulty input transformer

MOTOROLA P-69-14 Auto Radio

Same Case Histories as listed for Motorola 9-69 Auto Radio receiver

MOTOROLA 70 Auto Radio

Inoperative	1)	check dual 0.0008-mfd. condenser located near bottom of OZ4 tube
Distortion	1)	replace OZ4 tube
	2)	replace the two coupling condensers
Intermittent reception, Low volume	1)	see the Case History listing for this same trouble under Motorola "Golden Voice" receiver

MOTOROLA 75 Auto Radio

See also same Case History for "Loud background hum" as that listed for Motorola 57

Inoperative (no voltages)	1)	"shorted" 0.4-mfd. condenser on terminal strip
	2)	check both buffer condensers
	3)	check the two 6-mfd. 450-volt filter condensers
	4)	check 0.25-mfd. 400-volt tubular condenser connected to plate circuit of 78 r-f stage (if this condenser is "shorted," an ohmmeter will read 150 ohms from plate to ground)

(Cont'd over)

MOTOROLA 75 Auto Radio—*(Cont'd)*

Inoperative (all operating voltages O.K.)	1)	replace the 0.01-mfd. audio coupling condenser—even if it tests O.K.
Inoperative (especially on sets mounted upside down over steering column)	1)	check the rubber-covered leads in the vibrator where they are tied with cord at one end of the vibrator frame. Very often these leads break from the constant movement of the vibrator frame Replace leads with flexible wire
Intermittent reception	1)	"shorting" 0.01-mfd. coupling condenser (marked *1518*), between plate of '75 tube and grid of '41 tube
Howling	1)	"open" in the condenser block
Noisy, Rattling	1)	"loosened" self-threading screws which fasten 1st i-f shield can to chassis. Tighten

MOTOROLA 77 Auto Radio

Inoperative (no plate voltages)	1)	"shorted" 1600-volt condenser in vibrator
	2)	"open" r-f choke in base of vibrator
	3)	"shorted" 0.5-mfd. condenser in metal container on chassis
Low sensitivity	1)	faulty '39 type tube
	2)	"shorted" i-f trimmer condenser
	3)	faulty untuned r-f transformer
	4)	"open-circuit" in AVC network
Noisy	1)	faulty 6A4 tube
Rasping noise	1)	remove i-f transformers, and shorten leads from coils to lugs. The slack wire often forms loops which short to the shield can causing noise
Vibrator "hash"	1)	cut a piece of thin sheet metal to fit top of power pack and fasten it by the two screws which hold power transformer in place
	2)	bond top side of frame of first r-f section of gang condenser to chassis by means of flexible bonding braid
Hum	1)	hum due to audio oscillation may be remedied by connecting a small r-f choke in series with "B"-plus output circuit from the synchronous vibrator. Connect a 0.01-mfd. 600-volt by-pass condenser between chassis and low-potential end of this choke
Poor tone	1)	faulty last audio tube
	2)	faulty plate choke
	3)	no bias on last audio tubes. Check bias resistor network
	4)	faulty 65-mfd. electrolytic filter condensers in power unit
	5)	check to see if voice coil or field have been reversed. This causes voice coil form to become blackened and charred inside due to heating. If it is discolored and swollen, replace it.

MOTOROLA 77-A Auto Radio

Inoperative receiver	1)	faulty vibrator. Remove from housing. Check the two 0.007-mfd. condensers shunted across the rectifying vibrator points. Replace with 1600-volt oil-filled type condensers
	2)	short-circuited shunting condensers across rectifier points in vibrator. Replace with 0.007-mfd., 1600-volt oil-filled units

(Cont'd)

MOTOROLA 77-A Auto Radio—*(Cont'd)*

Low sensitivity	1)	excessive bias on type '85 tube. Reduce value of bias resistor to 500-ohms
	2)	i-f amplifier out of alignment
	3)	open-circuited resistor
Noisy	1)	locate the end lug on the bakelite strip—the one which is riveted to the chassis for "grounding." Solder this lug to the chassis to prevent noisy contact
Noisy when car is in motion	1)	broken soldered joint between antenna coil shield and chassis
	2)	corrosion of spring contact "grounding" the variable condenser rotors. Bond rotors to chassis with flexible pigtails
Distortion and loud whistles	1)	internal "breaking" of solid-wire cotton-covered connection between tone control and small fixed condenser mounted on chassis directly behind it
Poor tone	1)	faulty power tube
	2)	faulty coupling condenser
	3)	no bias on type 12A5 tubes

MOTOROLA 77-A (Series B) Auto Radio

Poor tone	1)	faulty 12A5 tube
	2)	faulty coupling condenser

Note: The time delay in the AVC action may be eliminated and the bass note response can be obtained if desired by making a slight change in the grid bias of the '85 diode tube. To do this, remove the connection now between the grid of the '85 tube and one end of the 250,000-ohm resistor in the i-f coil grid return line. Connect a 0.01-mfd. condenser in its place. Also connect a 100,000-ohm resistor from this same grid to the point where the above 250,000-ohm resistor connects to the other 250,000-ohm resistor (whose other end is "grounded" to the chassis).

MOTOROLA 78 Auto Radio

Poor tone	1)	check voice coil and field coil connections to determine if they have been reversed. If they have, the voice coil will likely be charred, in which case, replace both cone and voice coil

MOTOROLA 79 Auto Radio

Same Case History as that listed for "Loud background hum" for Motorola 57

MOTOROLA 80 Auto Radio

Inoperative (receiver draws over 20 amps. from battery)	1)	check the 0.008-mfd. (postage-stamp type) buffer condenser connected from plate of OZ4 rectifier to ground
Inoperative (no voltages)	1)	change OZ4 rectifier tube to a 6Y5 type
Fuse blows	1)	check vibrator
Intermittent operation	1)	inspect the ground-return lead under vibrator for loose or broken connection
Low sensitivity, Distortion	1)	check volume control
Hum and distortion when played at low volume	1)	volume control resistance increased to 8 megs. or more. Replace it. For temporary repair, shunt it with a 500,000-ohm resistor
Noisy	1)	check metal tubes for noise

MOTOROLA 82A

Whistling or squealing, or thumping on high-freq. end of short-wave band around 20 mc	1)	connect a 60-ohm non-inductive resistor directly in the grid lead at grid cap of mixer tube. This will act as a suppressor of oscillations

MOTOROLA 88 (Super "8") Auto Radio

Inoperative over part of dial	1)	try several new tubes in critical autodyne detector-oscillator circuit
	2)	if this fails to remedy trouble, try a 4,500-ohm cathode-bias resistor and resolder all oscillator circuit connections (including coil wires to terminal ulgs and connecting leads)
Low sensitivity	1)	"faulty" i-f unit
	2)	receiver circuits not aligned properly
	3)	faulty '36 tubes
	4)	if plate voltages are low, check for faulty "BR" rectifier tube, faulty buffer condensers, faulty Elkonode
"Noisy" operation	1)	coil shield cans not properly grounded
	2)	voice coil lead broken
	3)	poor connection on chassis plug
	4)	faulty volume control

MOTOROLA 89K1 (Clock Tuning)

Fails to turn on	1)	relay spring too stiff
Turns on, but intermittently fails to tune when buttons are pushed	1)	relay contacts are dirty, or contact springs are not stiff enough
Improper push-button tuning	1)	adjust relay reversing contacts so that action is positive
Poor switch contacts	1)	main motor switch must make positive contact when latch gate is pulled down by latch bar and the latch bar is resting on the *high* side of the latch ring. The reversing switch must reverse positively when the latch bar falls to the *low* side of the latch ring. Clean contacts with Carbona. If necessary adjust as per instructions in service notes
Faulty latch trigger	1)	if trigger fails to pull latch gate down, main motor switch will not close. Check trigger spring and trigger pivot for freedom from binding. Replace latch bar assembly if necessary
Motor resistor "open"	1)	check the 20-ohm resistor mounted across motor terminals (In Models 109K1 and 2, this resistor is replaced with a 60-mfd. motor starting condenser)
Power transformer "open"	1)	check output of power transformer secondary that supplies motor current. Should measure 24 volts across winding. (In Model 89K1 only, this winding has a tap at 6.3 volts for dial lights)

MOTOROLA 100 Auto Radio

Inoperative (no voltages)	1)	faulty '84 (lights up but no emission)
	2)	faulty vibrator
	3)	"shorted" tin-encased high-voltage condenser across plates of '84 tube
Low volume, Distortion (all tubes check O.K.)	1)	"open" in the tapped impedance choke located next to the 6A4 tube
	2)	remove i-f stage cathode resistor and "ground" the cathode terminal direct. Disconnect the suppressor grid from the chassis and tie it to the screen. Change the cathode resistor in the r-f stage to one of a lower value of about 350 ohms (if very high sensitivity is desired for distant reception, this cathode may be "grounded" directly to the chassis). Tie the suppressor grid of this tube to the cathode terminal

(Cont'd)

MOTOROLA 100 Auto Radio—(*Cont'd*)

Loud background hum, low volume, distortion	1)	replace the entire electrolytic filter condenser. To get to it, remove the screws holding the can in place on top of the shielded power transformer (which is located next to the vibrator). Lift the can off top of transformer. Replace the entire electrolytic condenser in it
Hum (filament ripple) excessive	1)	excessively long "A" leads, or high-resistance joints in the hot "A" or ground circuits of the set. The "A" leads should be as short as possible. Check for this trouble by securing a perfect "ground" on the radio set mounting bolts and connecting the "A" supply lead *directly* to the self-starter switch of the car. See if the receiver operates satisfactorily now
	2)	improperly matched last audio tubes. Check this by using a pair of tubes which have been properly matched in a tube checker
	3)	excessive spacing of the vibrator reeds. Check this by replacing with another vibrator
	4)	ripple occurring in the grid circuit of the '85 tube due to chassis currents. Check this by "shorting" the grid of the '85 tube directly to chassis with a screw driver. If this reduces the ripple materially, a simple corrective wiring change may be made in the receiver. *Proceed as follows*: With the set chassis placed on the bench so that you are facing the 4 tubes and output transformer assembly, remove the '37 tube and '85 tube from their respective sockets. Locate the black lead extending from the ground lug of the manual volume control to the ground lug of the small 4-contact dummy lug strip located at the top of the r-f tube shield. Next locate the black lead extending from this same lug on the 4-contact dummy lug strip down to the cathode of the '85 tube socket. Clip this lead off at both ends and remove it from the set completely. Disconnect the volume control ground lead from terminal No. 2 of the 4-contact dummy lug strip and "re-ground" this to the i-f coil can (the face directly behind the '85 tube) and at a point approximately 1¼ inch above the set chassis
To improve tone	1)	replace the original tone control arrangement with a variable type. A 0.1-mfd. condenser in series with a 500,000-ohm variable resistor is satisfactory

MOTOROLA 109K1 (Clock Tuning)

Same Case Histories as listed for Motorola 82A and 89K1 receivers

MOTOROLA 109K2 (Clock Tuning)

Same Case Histories as listed for Motorola 89K1

MOTOROLA 124

Tuning motor runs constantly	1)	*white* wire "grounded" where it goes through dial assembly

MOTOROLA 500, 550, 700 Auto Radios

See also Case Histories listed for Motorola 9-69 Auto Radio

Excessive ripple (in Model 700)	1)	dress 6Q7GT driver grid lead around tube shield away from power transf. Cut the heavy bond running from ground terminals of driver tube socket to vol. control

MOTOROLA 860, 880 Auto Radios

Loss of volume and tone accompanied by "quivering" in program while car is driven over rough road	1)	movable contact of "muting switch" vibrates, touching fixed contact. Bend down part of the bracket holding spring of movable contact until gap is great enough to prevent this vibratory contact without hindering the switch-closing action

NATIONAL PFANSTIEL

(See Case Histories listed under PFANSTIEL)

NOBLITT-SPARKS

(See Case Histories listed under ARVIN)

NORCO

(See Case Histories listed under REMLER)

NORTHERN ELECTRIC *(CANADIAN)*

NORTHERN ELECTRIC (CANADIAN) "MINAKI" (Midget Receiver)

Inoperative	1)	"shorted" tubular type 0.1-mfd. plate by-pass condenser

NORTHERN ELECTRIC (CANADIAN) 81

Poor reception on short-wave bands (especially on the high freq.)	1)	open the ground connection at the wave-band switch contact arms, connect these two arms in common to a 0.005-mfd. condenser and connect the other terminal of this condenser to ground
Broad tuning	1)	replace the first and second i-f transformers. These are designed incorrectly

NORTHERN ELECTRIC (CANADIAN) 101

Low volume (last i-f tube voltages low)	1)	"leaky" tubular condenser mounted inside the last i-f transformer
Poor reception on s.w. bands	1)	reduce the bias on the third i-f tube
Broad tuning	1)	replace the first and second i-f transformers. These are designed incorrectly

NORTHERN ELECTRIC 160

Low volume (all voltages and tubes check O.K.)	1)	faulty volume control. Wear in it causes carbon to deposit on moving contact, causing a 1,000-ohm loop to ground. Install a new 500,000-ohm volume control

OLDSMOBILE *(United Motors Service)* AUTO RADIOS

OLDSMOBILE 1933 Auto Radio

Inoperative (vibrator operates but set does not light up)	1)	"broken" "A" choke lead to static condenser on side of receiver

(Cont'd)

OLDSMOBILE 1933 Auto Radio—*(Cont'd)*

Inoperative (no plate voltage on output tube)	1)	check small 0.006-mfd. condenser connected from plate of output tube to "ground." Replace with 1,000-v. unit
Intermittent "quivering" operation	1) 2)	faulty vibrator check tubes, especially the 6F7

OLDSMOBILE 1934 Auto Radio

Motorboating, Steady whistle	1)	"break" in an r-f cathode by-pass condenser lead (usually the lead of the largest condenser of the cluster of three, jammed between lid and other two)

OLDSMOBILE 1936 Auto Radio

Inoperative (no plate voltage on output tube)	1)	check the 0.006-mfd. condenser. Use a 1,000-volt paper condenser for replacement

OLDSMOBILE 1938 De Luxe Auto Radio

Blows fuses	1)	OZ4G cold-cathode rectifier at fault. Wire the rectifier socket for a 6X5G rectifier tube. To do this, run a hot "A" lead to one of the filament prongs on socket, as other prong is already grounded to chassis. Use a 6X5G tube

OLDSMOBILE 1939 Auto Radio

Dial mechanism sticks	1)	carefully grind off studs which hold scale on dial drum so they are just flush with scale

OLDSMOBILE 405046 Auto Radio

Mushy tone, Fading	1)	replace 0.02-mfd. (*C-21A*) condenser coupling triode plate of 6F7 to control grid of 85. Also connect a 0.04 mfd. condenser (*C-21B*) between the triode grid and center tap of volume control

OLDSMOBILE 982006

Intermittent fading, Squealing	1)	solder piece of flexible bonding braid between ground terminal of volume control and chassis

OLDSMOBILE 982045

Oscillation at both ends of dial	1) 2)	check alignment if alignment is O.K., lower the value of oscillator grid leak shunted across low-freq. oscillator padder to 20,000 ohms

OLDSMOBILE 982161

Whistling or squealing	1)	caused by i-f amplifier oscillation. Connect a mica condenser from 7B6 diodes to ground. Try several values around 0.0005-mfd.—do not use too large a capacity as distortion will result

OZARKA

OZARKA 89

Inoperative	1)	movable plates of tuning condenser "shorted" to stators. Replace

OZARKA 90

Inoperative	1)	movable plates of tuning condenser "shorted" to stators. Replace
Inoperative	1)	if there is a voltage reading at "high" side of speaker but none at "low" side, check the three by-pass condenser sections for a "shorted" unit

OZARKA 92

Inoperative	1)	movable plates of tuning condenser "shorted" to stators. Replace

OZARKA 93, 94AVC

No control of volume	1)	open-circuiting of 250,000-ohm resistor connected between the movable arm of the volume control and the center tap of the high-voltage secondary. Replace
Hum	1)	open-circuited 350,000-ohm resistor in the type '47 tube control-grid circuit

PACIFIC

PACIFIC 25

Erratic band-change action, Microphonic, Intermittent	1)	rotor of band switch rides on outside of stator members instead of on top of them. Remove the rotor retainer horseshoe piece and slip the rotor back about an inch; if any of the stator members do not show definite wiper tracks they should be bent outward

PACIFIC 34

Weak on broadcast band—O.K. on short waves	1)	"open" primary in broadcast antenna coupling coil

PACKARD-BELL

PACKARD-BELL 48

No indication on 6G5 tuning eye tube (receiver operates O.K. otherwise)	1)	"open" 1-megohm resistor in the base of the 6G5 tube socket

PACKARD-BELL 120 (1937)

Distortion	1)	shunt the 250-ohm bias resistor of the 6F5 audio tube with an additional resistor of 400 ohms

PACKARD MOTOR CAR CO.

PACKARD-PHILCO H122 Auto Radio

Inoperative (no voltages when turned on, but receiver apparently O.K. when cold)	1)	0.01-mfd. condenser across the rectifier plates "shorts" under load. This unit is located directly under the rectifier socket and can be seen through a small hole in the bottom of the chassis. Replace with a 1000-volt condenser

PACKARD-PHILCO P-1417, P-1430

Ignition noise	1)	use a distributor choke in place of the suppressor resistor supplied with set
	2)	install an efficient dome-light filter high in the right corner post—it must not interfere with closing of the door

PACKARD-PHILCO P-1617, P-1630, P-1635

Automatic tuning cannot be adjusted to low-freq. stations	1)	coil inductance decreased by "shorted" turns. Inspect coil and repair—or replace

PATTERSON

PATTERSON 7-Tube Model

Low volume, Insensitive	1)	deterioration of the i-f transformers. Replace with new high quality i-f units. Then realign the receiver

PATTERSON 8-Tube Model

Distortion	1)	faulty resistor in the cathode circuit of the '27 detector tube

PATTERSON 70-AW, 107-AW, 207-AW, 210-AW

I-f tubes block on local stations	1)	disconnect the antenna. Install a switch in this circuit for receiving "locals"
Poor quality at low volume	1)	aerial too long
60-cycle hum	1)	"faulty" '82 tube. Replace

PEERLESS

PEERLESS 20 SERIES

Ballast tube "blows"	1)	carbonized type '80 tube rectifier socket
Intermittent reception	1)	faulty condenser connected from detector grid coil to ground

PEERLESS COURIER 65

Inoperative	1)	short-circuited terminals or sections on Kylectron speaker
	2)	short-circuited r-f plate by-pass cond.
	3)	short-circuited screen by-pass condensers
	4)	open-circuited sections in voltage divider
Fading, Intermittent reception	1)	open-circuited 0.01-mfd. audio coupling condenser
	2)	short-circuiting terminals on Kylectron speaker
	3)	"leaky" detector plate by-pass condenser
	4)	check for change in value of 5,000-ohm *blue-and-white* screen grid resistor. Replace with 5-watt unit
Choked, Weak reception	1)	open-circuited 0.01-mfd. audio coupling condenser
Noisy, Weak reception	1)	"leaky" or "open" 0.00035-mfd. r-f plate by-pass condensers across split primary winding
	2)	sections of Kylectron speaker "sparking"
	3)	contact arm (or resistance element) in volume control dirty
Incomplete control of volume	1)	replace the 800-ohm cathode bias volume control with a 5,000- or 10,000-ohm type
Distortion, Poor control of volume	1)	carbonized 5,000-ohm r-f screen cathode carbon resistors
Whistling or squealing	1)	oscillation persisting after all usual remedies have been applied may usually be stopped by connecting a 0.1-mfd. condenser from the contact arm of the volume control (opposite the "grounded" contact) to ground on the chassis

PEERLESS 70, 71, 72

Inoperative	1)	detector tuning condenser lug "shorting" to tube shield
Rectifier tube "blows"	1)	temporary breakdown of first or second filter condenser (test each under load)
Weak, Noisy reception	1)	"leaky" 0.00035-mfd. r-f plate by-pass condensers across split primary winding
	2)	volume control resistance element (or contact) dirty

"PETER PAN" Receivers

See also the Case History listings under Jackson-Bell

"PETER PAN"

Inoperative (4.5 volts across filter input)	1)	0.01-mfd., 600-volt by-pass condenser from the plate of the '42 tube to ground "shorted"
	2)	inspect the soldered joints on the coils under the tape. They often corrode
Replacing noisy volume control in models employing two '24s, a '47 and an '80 tube	1)	be sure that new control is grounded at the center lug which goes to the movable arm. If it is not grounded through the mounting, use a short lead to ground it

"PETER PAN" 34

Inoperative, Weak, Intermittent reception	1)	check for a wire "shorting" the screen to the suppressor at the 42 tube socket
Distortion	1)	replace the 0.1-mfd. by-pass condenser connected from the 6J7 screen to ground

PFANSTIEL

PFANSTIEL (NATIONAL)

(Midget Model employing an '80, 47 and two '35 tubes)

Inoperative, Weak reception, Intermittent reception, Fading	1)	enamel on wire of oscillator coil burns due to insufficient insulation on high-voltage lead to coil. This causes turn-to-turn "shorts" with resulting change in inductance. Replace with a new coil if necessary. Realign the receiver

PFANSTIEL Receivers using Dynatron Oscillators

In Pfanstiel receivers using '24 tubes as dynatron oscillators, a type '57 tube can easily be substituted for the '24. The tuned circuits need not be disturbed.

PFANSTIEL 20

Weak reception, Distortion	1)	faulty blocking condenser (feeding the grid of the last a-f tube)

PHILCO

(See also Case History listings under Chrysler-Philco, DeSoto-Philco, Dodge-Philco, Ford-Philco, Graham-Philco, Hupmobile-Philco, Lincoln-Philco, Nash-Philco, Packard-Philco, Studebaker-Philco, Willys Overland-Philco)

PHILCO Auto Radios—General Servicing Data

Noisy, Motor noise, Motorboating sound	1)	check the antenna connector for poor contact. Often this coupler becomes corroded, or the spring loses tension. Stretching the spring is only a temporary repair. For a permanent job insert an additional spring under the original one. A fibre washer between the two will help to keep them in place

(Cont'd)

PHILCO Auto Radios—General Servicing Data—*(Cont'd)*

Inoperative (blown fuse and burned power transformer)	1)	vibrator sticking caused direct short on power transformer. Bend right angle lip on vibrator reed enough to clear magnet
Custom Philco auto radio	1)	burning of wires to control head. Two wires coming from the tuning head are held in position by a thin clamp. This is not necessary, and in many cases where the U-clamp is drawn up tight it punctures the insulation causing a "short"

PHILCO Home Radios—General Servicing Data

Note (A) ("intermittent" trouble conditions in some models)	1)	the critical reaction to signal and voltage surges which result when attempts are made to check Philco bakelite-encased type condensers for the faulty one producing an "intermittent" condition, makes the replacement of all condensers of this type (used either as coupling or by-pass condensers, as the case may be) the most practical means of correcting the trouble. As a rule, condensers of this type used in an audio-coupling capacity are most troublesome, but their intermittent operation is also troublesome when they are used for other purposes in the circuit
Note (B) (troubles in models employing a particular type of i-f transformer)	1)	this type i-f transformer is the one having the coil leads wrapped and soldered around the external leads which are brought out from the inside of the transformer through the cardboard washer at its base. At the points where the coil leads and external leads are soldered together, imperfect soldered and unsoldered connections occur. These defective joints often are not revealed by jarring the transformer (and sometimes the slight surge caused by an ohmeter closes the circuit), because the impregnating wax covers the connection and thus holds the wires together. Removing the transformer from the can and inspecting visually is the most practical method of checking for this condition
Note (C) (troubles in models employing a particular type of i-f transformer)	1)	this type transformer is the one having the primary and secondary coils spaced closely together. The leads to the external terminal lugs from one coil pass adirectly over the other coil, the whole being wrapped with insulating paper held in place with a rubber band. At the points where these leads pass over the other winding, the insulation on the wire breaks down, thus causing an interwinding "short" and allowing plate voltage to enter the grid coil. A *positive* voltage (depending in magnitude upon the resistance of the "short") on the control-grid or cathode of the i-f tubes will indicate the presence of this condition
Note (D) (troubles in models employing a particular type of oscillator transformer)	1)	this type of transformer has the windings for the various bands all wound on the same form. At the top of the coil near the high-frequency padders are two lugs. Through the eyelet of one of these lugs is run the two wires forming the center-tap of the broadcast band coil, which connects to the broadcast band low-frequency padder; through the eyelet of the other lug runs the end of the broadcast band coil which connects to the high-frequency broadcast band padder. Broken wires occur at both these points, and may be easily detected by prodding with a needle. A continuity check on the coil may indicate a complete circuit, as the wire is held against the lug and eyelet by the impregnating compound. Hence removal of the can, and visual inspection as described is the easiest and surest method. The coil leads are wrapped around these lugs numerous times and oftimes are imperfectly soldered; visual inspection will reveal this immediately. On the later design of transformer of this type (using a screw as the padder adjustment), an additional trouble occurs. This is a "short" between the grounded frame of the padders and the lug to which the high-frequency broadcast band padder is connected. It is usually caused by a small piece of solder wedged between the lug and the padder frame. Visual inspection is again the surest and easiest way to locate the fault, if it is intermittent and a continuity check for "grounds" disturbs the condition.

(Cont'd)

PHILCO Home Radios—General Servicing Data—*(Cont'd)*

ote (E) _____1) (troubles in models employing a particular type of r-f transformer)

this type transformer has the windings for the various bands all wound on the same form. Trouble occurs most frequently at three places i.e., (*a*) where the broadcast band primary and secondary leads are brought from the outside of the form to the inside and thence to the terminal lugs; (*b*) where the broadcast band primary coil rests on top of the flat secondary winding; (*c*) where the short wave primary is wound between the turns of the heavy bare short wave secondary. The insulation often breaks through at these three points, allowing the wires of the two winding to touch, thus causing an inter-winding short. The best way to locate this condition is by means of a high-range ohmeter. Care should be observed when testing however, as the condition is oftimes intermittent and a voltage interruption or surge will burn the short clear. As this condition can only occur in the #2 r-f transformer, the presence of a *positive* voltage on the detector control grid, however small, is really evidence of a defective transformer

ote (F) _____1) (troubles in models employing "unit" construction)

recurrently broken wires are found between the coil and the waveband switch, especially the fine wires from the primaries. Inspection is the quickest way to locate them. Broken leads also occur where the lead from the tuning condenser stators runs through the chassis to connect to the frequency switch. By visual inspection, or pulling on these leads with a hook, the broken one may be located.

Oftimes the waveband switch "shorts" between segments of the moving contact either because of small particles of metallic matter shorting between the segments, or because of metallic matter present in the fibre insulating section. This condition can be detected by disconnecting the coil, and testing for a "short" with an ohmeter. To correct the condition, impress a high voltage across the switch terminals, with the coil disconnected, thus burning out the short

ote (G) _____1) (troubles in models employing "gang" type compensating condensers)

in this type of compensating condenser assembly, the common plates of the padders are "grounded" through the frame of the assembly and thence to the chassis through the mounting rivets. Loose mounting rivets allow a variable resistance to build up between the padder plate and ground. This results in station drift (if the padders are in the oscillator section where this condition is most noticeable), or results in slight changes in sensitivity, (if the padders are used in the r-f stages). Tightening the rivets with a hammer and punch will eliminate the trouble, however, soldering a wire to the ground plates and thence to the chassis is a more convenient and permanent remedy

ote (H) _____1) (electric dial troubles in models employing automatic tuning)

the "audio shorting" switch, which is operated by the indexing handle, sometimes "shorts," resulting in an inoperative receiver. This short may "make" and "break" by moving the index handle or the dial and thus become evident, or it may be revealed by removing the wire to the lug directly under the pilot lamp bracket and testing for a "short" with an ohmeter. This short may develop from the fibre plunger on the index handle assembly breaking and allowing the rotating contact to short, or it may result from wear or break on the insulating sleeve or the spaghetti which covers the fixed contact. By removing the retaining springs and the dial assembly, thus exposing these insulators to view, the break may be found

ote (I) _____1) (troubles in models employing later type anti backlash dial drive assembly)

play between knob and dial or condenser rotors may be overcome by unmeshing the gears and advancing the floating half of the gear one tooth against the fixed gear. Make sure the dial scale does not bind at the guides. If the drive assembly is locked or very stiff, the trouble is usually found to be due to the gear (to which is mounted the dial scale assembly) binding on the brass shaft. By removing this gear and reaming it out, the trouble may be eliminated

ote (J) _____1) (troubles in models employing cone-centric tuning)

when the tuning handle is pushed into position and the signal is cut off, it indicates that the a-f "shorting" switch is not breaking the circuit. This may be due to the copper contact which rides the circular ring being bent—in which case it may be bent back into the proper adjustment. It may also be due to a defective cone which should be replaced, or to the entire assembly being

(Cont'd)

PHILCO Home Radios—General Servicing Data—*(Cont'd)*

Note (J) _____ (troubles in models employing cone-centric tuning) *(Cont'd.)*

twisted with respect to the tuning condenser shaft. This may also be bent back into position. Lastly, the selector handle may be "bent," in which case it is easiest to replace the selector handle (in some cases it is necessary to replace the entire cone-centric assembly). If the receiver is "noisy" when dial is turned, clean and polish the spring (located under the dial) and the facing on which the spring rides

Note (K) _____1) (mechanical dial troubles in models employing automatic tuning)

several things often happen to cause slipping or backlash in the drive (most pronounced in the vernier knob). The dial scale should be checked first for "binding" at the guides. The reflector ring in back of the mask should be checked for trueness and tension, (too much tension causes slipping). Especially look at the spring fingers on this ring to see that they are not digging into the mask. If any doubt exists, replace the reflector ring. Check the mask to see that it is not binding on its housing, scraping with a knife will insure plenty of clearance. The dial itself should be checked to ascertain if it is binding on the insulation covering the a-f "shorting" switch contact. "Play" in the dial or knobs may be taken care of by advancing the floating gear one tooth against the fixed gear

Note (L) _____1) (trouble in a type of i-f padding condenser assembly)

these padders develop an intermittent condition as a result of either dirty or sloppy connections between plates through the rivet, or foreign matter between the plates. By tapping the i-f shield under which the faulty compensator is located, and noting the intermittent effect upon the signal, the faulty compensator may be located

More positive results can be obtained by "padding" the i-f amplifier stages. In this way the faulty compensator will manifest itself by a "clicking" or "scratching" sound, and an intermittent effect on the signal strength when turned. It is usually best to replace all assemblies found faulty

Note (M) _____1) (troubles due to loose shielding)

on models using a spring clip type mounting for the r-f, i-f and oscillator coil shields, dirt sifts between the contact points on some (and in the rivet which holds the clip to the can on others) causing a high-resistance ground contact and thus producing noise or oscillation in reception. The cans should be removed and the clips spread and rivets tightened, or else a wire should be soldered to the chassis and thence to the shield (connect it to the coil mounting screw, as the can cannot be soldered onto). These loose cans and shields may be detected by feeling for play in their mountings. On the 1938 series, the shields are bolted on, and often these bolts become loose. All that is necessary in such cases is to tighten the bolts. The grounds holding the tube shields, lugs and sockets should also be checked for tightness of the rivets

Note (N) _____1) (troubles in models employing a particular type of power transformer)

on this type of power transformer the external leads were covered with a rubber insulation whose melting point was too low, consequently at the points of higher temperature beneath the chassis this insulation would melt and cause;

(*a*) A "short" across the rectifier plates, resulting in no a-c plate voltage on the rectifier and the resultant overheating of the power transformer with a consequent smell and the running out of the impregnating wax from inside the transformer

(*b*) A "ground" between either of the rectifier plates and the chassis, resulting in lack of plate voltage on all of the tubes, and evidenced by the burning of the bias resistors

(*c*) A "ground" or "short" on the filament line, resulting in overheating of the power transformer and a lack of filament voltage anywhere

(*d*) A "short" in the primary circuit of the power transformer. This usually blows the house fuses

(*e*) A "ground" in the primary circuit of the power transformer, resulting in a heavy 60-cycle hum from the speaker

Note (O) _____1) (troubles in models employing Wireless "Mystery Control")

the following symptoms can be taken care of by the simple electrical or mechanical adjustments listed. If these remedies listed do not affect the symptoms, time and trouble can be saved by replacing the "stepper" assembly entirely.

(*a*) *Station or Volume Changes Without Operating the Control Box:*

(Cont'd over)

PHILCO Home Radios—General Servicing Data—*(Cont'd)*

Note (O) (troubles in models employing Wireless "Mystery Control") —*(Cont'd)*	Sensitivity control advanced too much; noisy tube in control system; control system out of alignment; local interference *(b) Volume Control Motor Constantly Runs in Either Direction*: Adjust clearance screw at center of holding relay armature clockwise about one-fourth turn (in earlier models without this adjustment, increase tension on armature spring): clean burrs from primary switch contacts with fine sandpaper and lubricate with white vaseline; check tension on primary homing-spring: increase tension by releasing set-screw at center of "stepper" chassis and turning the slotted end of the shaft until the torque increases to two ounces on the primary ratchet; check tension of contact finger against primary contact for one ounce pressure; check dressing of wires to see that no wire interferes with return of primary switch contact *(c) Failure to Reach Station Dialed*: Check for weak battery in control box; check for low line voltage; check alignment of control system (if there is a defective transformer in control system it will manifest itself by its lack of peak when padded); check station selector switch for binding, check for too much tension in primary homing-spring (two ounces); check for too much tension on secondary ratchet spring (three ounces); check control box pulser brake arm against the contacts) replace pulser if this is found; lubricate stepper relay armature and drive pawl with "fine" oil; check pulser speed (five to eight pulses per second); check filament voltage of thyratron tube for being low (replace filament transformer—#48 in model 39-55 & #78 on model 39-116); check thyratron tube by substituting new one; check holding relay for not holding each advance of stepper relay (if it jumps or chatters during the course of the pulses, adjust clearance screw at center of holding armature counter-clockwise about one-eighth turn); check to see that driving pawl is moving primary ratchet wheel only one tooth per pulse; adjust position of stepper relay with respect to case *(d) Tuning Remains on #8 Station*: Holding relay not releasing, adjust clearance screw as described in item *(b)*, check for jamming of primary homing-spring. *(e) Drops Back One Station from that Dialed*: Adjust secondary holding pawl by running the stepper by hand to #8 station (holding in the holding relay with one finger throughout) then pull out the secondary holding pawl and adjust so that it just rests on the tip of the tooth, (when adjusted properly it may be pushed down in the slot of the #8 tooth by a slight pressure) *(f) Operation at "Soft Volume" Position Causes Station to Drop Back One Position*: Adjust secondary holding pawl as in item *(e)* *(g) Receiver Inoperative On "Remote" Operation*: Fiber arm slot of muting switch out of driving pin, clean burrs from primary muting switch contact as in item *(b)* if primary switch fails to return home—also see item *(d)* *(h) Fails to Mute*: Check "muting switch" adjustments *(i) Receiver Turns On, Volume Control Continues to Full Volume, then Starts Back to Low Volume or Shuts Receiver Off and Continues Cycle*: Examine the switching arm to see if it catches as it comes back—or if small metallic filings or dust have gotten between the contacts. If it is the former, file the contacts lightly; if the latter, remove such particles with a bit of cloth dipped in carbon tetrachloride or alcohol. *Do not attempt to adjust tension of spring* *(j) Motor Continues to Run After Receiver Shuts Off*: Check for "sticking" holding magnet in stepper box. If a slight tap on the box stops this trouble, it indicates that this is the cause. In this event, locate the screw that maintains a slight clearance on the armature face. Turn it *slightly* clockwise to eliminate the trouble *(k) Erratic Operation of the "Stepper"*: Usually caused by bad contacts in the "Pulser" box—particularly the silver contact from shaft to moving arm. Any resistance in this contact will broaden the tuning and decrease the output, as it is in the oscillating circuit

(Cont'd)

PHILCO Home Radios—General Servicing Data—*(Cont'd)*

Note (P) (troubles in models employing a particular type of output transformer)	1)	the insulation on the primary leads of these output transformers develops the same trouble as that described here in Note (N). It breaks down and "shorts" the plate voltage to ground either before or after it reaches the primary winding. The ground occurs usually where these leads are in proximity to the power transformer, particularly when they are anchored at a bend by a clip fastened to the chassis. Covering these leads with spaghetti will offer a permanent remedy for this trouble
Intermittent reception, Fading (in all receiver models to 1936)	1)	snapped or loosened leads inside block type condenser cases due to warping of casings. Replace all block-type condensers having lug terminals
	2)	check bakelite-encased coupling condenser between 2nd det. and 1st audio tubes
Intermittent reception, Microphonic noise, (in Midget receivers)	1)	mechanical vibration of the condenser plates. Check the stator plate supports and make sure they have not come loose
Weak reception at low frequencies (receiver using '36 tube as detector oscillator)	1)	try an 8,000-ohm bias resistor for the tube. If often helps to realign the i-f at a lower value, say from 460 down to 440 kc
	2)	moisture accumulating on the wiring and coils. Bake out in warm oven. Replace oscillator coil if necessary
Distortion at any setting of volume control	1)	in receiver types using a 75 det.-1st a-f tube biased by a resistor and using bakelite-encased condensers, check the 75 tube plate by-pass condenser for "leakage" (this is part of a dual condenser unit)
Interference when tuned manually, O.K when push-buttons are used	1)	in receiver types with built-in antenna try a new dial light on the dial switch that is operated by the band switch, and see that the new light makes good connection
"Shadowgraph" tuning indicator fails to indicate at all	1)	this instrument indicates the change in plate current of the controlled tubes. Dead tubes, trouble in the AVC circuits, insufficient signal pickup due to a broken antenna, one that is too short or one that is in a poor location will cause this trouble
"Shadow" width does not change sufficiently on any station	1)	look for faulty aerial connection, or to short an aerial
No light on "Shadowgraph" screen	1)	remove the '80 rectifier tube and turn on the set. Then adjust the reflector in the pilot lamp. Replace the rectifier. There are no adjustments inside the shadow-box
"Shadowgraph" shadow too faint, "Shadow" not centered on screen	1)	remove the '80 rectifier tube. Turn on the receiver and move and focus the lamp by bending the bracket slightly to obtain a sharp shadow of the smallest possible width exactly in center of screen. Return the '80 tube to its socket
"Shadow" not sharp on one side	1)	remove the '80 rectifier tube. Pry out the lamp reflector tube. Pry off the lamp reflector and adjust the lamp position by turning lamp and socket clockwise until the filament supports are parallel to back of shadow tuning box. Us

(Cont'd

PHILCO Home Radios—General Servicing Data—*(Cont'd)*

"Shadow" not sharp on one side *(Cont'd.)*		Philco pilot lamps with straight filament. It may be necessary to make a further adjustment by bending the bracket slightly to obtain a sharp shadow of the smallest possible width in exactly the center of the screen. Replace the '80 tube
"Shadow" remains at minimum width while tuning dial is turned several divisions	1)	compensating condensers are out of adjustment causing receiver to tune broadly. Realign the receiver
White light between screen and bezel opening of "Shadowgraph"	1)	remove the '80 rectifier. Turn on set. Loosen shadow-tuning box mounting screws and move box found tight against back of bezel. Center shadow properly with respect to bezel opening. Tighten the screws. Replace the '80 tube
Dial cables slip	1)	smear the cables with rosin
Friction drive allows dial to slide off all-wave models	1)	make a small dog-ear on each end of track engaged by driver
Phono combinations	1)	if hum is experienced and tubes and parts check O. K., ground frame of phono motor to chassis
	2)	if microphonic rumble and distortion are experienced, check to make sure that shipping bolts have been loosened on phono chassis so it can float freely on the spring supports
Magnetic tuning models	1)	if magnetic tuning will not hold station, check discriminator tube
	2)	replace type 6N7 oscillator tube
	3)	if tubes are O.K., align receiver according to manufacturer's special aligning instructions
Midget receivers	1)	tuning vernier inoperative due to wear in ball-race. Remove collar and pull out shaft (being careful not to lose ball bearings). Replace small end of shaft on flat of vice and give several good taps with a large hammer (after having made sure that condenser proper runs free in its own bearings)
Portable receivers	1)	intermittent reception in models with series aerial jack in side of case may be caused by the jack. Clean contacts and install stiff paper shield over jack to prevent accidental bumping during battery replacement

PHILCO RP-1 (Code 121) Wireless Record Player

Circuit changes for improved performance	1)	disconnect and remove the small radiating antenna from inside of cabinet. Connect one termnial of a 30-mmfd. mica type condenser (Part *No. 30-1059*) between the point where the Oscillator Transformer *No. 18* and the Oscillator Grid Condenser *No. 8* are connected. Connect the other side of the condenser to the power line, on the "hot" side of the master switch. Remove dual 0.01-mfd. line condenser *No. 4*. Connect a 0.01-mfd. (*Part No. 3903SG*) condenser from "common" side of power line source to chassis ground. These changes cause the r-f output of the player to be fed to the receiver through the power line instead of directly from the radiating antenna

PHILCO TH-1

Weak reception	1)	check 500,000-ohm 6C6 plate resistor for increase in resistance

PHILCO PT-2 Auto Radio

Motorboating sound while heating—then dead	1)	check for short between windings of second i-f transformer by measuring the 75 diode plates to ground. Should be zero with aerial disconnected, negative with signal. If otherwise, remove coil and tape coil leads to prevent shorting

PHILCO RP-2 (Code 121) Wireless Record Player

Same Case History as that listed for Philco RP-1 (Code 121) Wireless Record Player

PHILCO 3 TRANSITONE Auto Radio

Inoperative, Weak	1)	check '01A tubes
	2)	check B-eliminator unit
Inoperative (tubes and voltages test O.K.)	1)	water in the compensating condensers. This usually gets into them during a rainstorm or while the car is being washed. Remove the mica insulation and dry it thoroughly
	2)	loosening of field connections in speaker. Test for this condition by carefully sticking a piece of steel wire through the screen cover of the speaker with the set turned on, touching the wire to the centering screw of the cone. If the wire fails to stick, the field circuit is "open"
	3)	check D.P.D.T. switch which controls "A" and "B" power
	4)	check for broken wires at plugs
	5)	check for broken leads to the a-f transformer and to the volume control inside the control cable
Dynamotor noise comes through	1)	connect 1-mfd. condenser (directly at dynamotor) between "A"-hot and ground

PHILCO 4, 4C Short Wave Converter

Inoperative, Weak	1)	open circuit in waveband switch *No. 8*. Clean contacts
Inoperative (over part of band)	1)	solder pigtail from frame of tuning condenser to ground
	2)	clean "ground" contacts on rotors of tuning condensers
Intermittent reception	1)	check wave trap for "open" or "short"

PHILCO TH-4 TRANSITONE Home Radio

Hum	1)	check det.-1st audio tube
	2)	check output tube

PHILCO 5 TRANSITONE Auto Radio

Inoperative (no voltage but '84 tube and vibrator O.K.)	1)	high-voltage 0.01-mfd. condenser across plates of '84 rcetifier tube shorted
	2)	shorted electrolytic filter condenser in block
Inoperative, (no plate or screen voltage) (primary draws 10 to 15 amps.)	1)	breakdown of power transformer windings. Rewind windings or replace with new unit

(Cont'd)

PHILCO 5 TRANSITONE Auto Radio—*(Cont'd)*

Intermittent reception (plays satisfactorily when the chassis is jarred)	1)	loose nuts holding the i-f coil in place. Tighten them
Weak reception	1)	"shorted" 20-mfd. cathode by-pass cond. in 41 output tube circuit. This unit is part of a block of 4 condensers. Replace entire block
	2)	realign i-f amplifier
	3)	short out one side of volume control, thus raising bias voltage
	4)	check for faulty 0.05-mfd. by-pass condenser between secondary of second i-f transformer and one terminal of volume control. It is directly beneath the 75 tube socket
Scratching noise when tuning	1)	tighten volume control nut in chassis and be sure it is well grounded
Poor AVC action, Distortion, Very broad tuning	1)	volume control has increased greatly in resistance value. Replace with a 350,-000-ohm unit
Distortion, Low voltages, 41 power tube glows red	1)	check 75 tube, 84 tube and vibrator and replace if faulty
	2)	"open" primary of output transformer (located on speaker panel
Howling intermittently when volume is turned up	1)	caused by output transformer terminals making intermittent contact with volume control terminals and shields. Place piece of insulating paper between transformer terminals and other components
Whistling and code-signal interference between 500 and 750 kc	1)	faulty 0.006-mfd. condenser connected between plate of 41 output tube and ground (located directly beneath the socket)
Whistling, "Birdies," Distortion	1)	faulty 0.05-mfd. by-pass condenser between secondary of antenna and coil and ground
	2)	pull the 15,000-ohm resistor in the 6A7 tube circuit up toward the front of the chassis
"Swishing" noise	1)	replace faulty 78 tube
Frying or crackling noises (in early serial numbers)	1)	if eliminator checks O.K., remove grid clip from 6A7 tube cap and remove lead from clip. Using same size stranded wire with good insulation, wind an r-f choke of 5 turns on the clip. Reconnect the lead
Fuses blow	1)	defective vibrator unit. Adjust or replace with new unit

PHILCO AR-5

Push-button operation "hard"	1)	when the push-button tuning flexible shaft is coupled to the rubber coupling in the receiver and the cap on the flexible shaft casing is seated, quite a bit of pressure is exerted on the switch and there is quite a bit of friction set up between the shaft and the casing. Then, when the dial tuning indexing mechanism is released and the push-button is operated, the drag on the shaft will cause a lag on the first rotation of the shaft and the switch contacts will not line up properly. Before the cap on the shaft casing is seated, push the spline on the flexible shaft deeper into the rubber coupling, using a small screwdriver and then seat the casing. This frees the flexible shaft and eases the pressure on the wafer switch. The push-button operation will be much easier and there will be no lag.

PHILCO TH-5, TP-5 TRANSITONE Home Radios

Hum	1)	check the det.-1st audio tube
	2)	check output tube

PHILCO 6, B6, 6F TRANSITONE Auto Radios

Inoperative	1)	battery connections to dynamotor reversed
Inoperative, No voltages (No. 6F receiver)	1)	remove power pack from side of set and check 84 tube, vibrator and electrolytic filter condenser. Vibrator may buzz but may not be good
Oscillator inoperative at high frequencies	1)	defective type '36 tube (even though it tests O.K.). Replace with new tube by substitution
	2)	lower the value of the type '36 cathode bias resistor from 5,000- to 7,000-ohms
	3)	check screen grid resistor for increased value. Replace with 20,000-ohm 1-watt unit
Fading, Insensitive	1)	intermittent increase in resistance of oscillator coil from 4- to about 45-ohms. Replace with new coil and realign the receiver circuits
Weak signals	1)	"shorted" 20-mfd. cathode by-pass in the 41 output tube circuit. This unit is part of a block of 4 condensers. Replace entire block
Noisy	1)	screen grid resistor vibrating against i-f padders, causing intermittent "short"
Loud buzz when receiver is turned on	1)	if buzz disappears when cathode of 75 or 72 tubes are grounded, replace dual 10-mfd. cathode by-pass condenser located in tube compartment
Whistle and scraping when tuning stations	1)	place length of copper shield braid around rotor shaft of tuning condensers, and pull toward front end. Place ends into holes in front of condenser and solder. Shield braid must be taut

PHILCO 7 TRANSITONE Auto Radio

No signals at some frequencies	1)	a critical oscillator circuit is employed. Try another 36 tube in this socket
Scratching noise when tuning	1)	tighten volume control nut in chassis, and be sure it is well grounded
Noisy operation on all stations	1)	replace the 0.001-mfd. plate by-pass condenser. If this condenser tests O.K., it may be necessary to replace it with a 0.002-mfd. unit

PHILCO TH-7

Distortion developing after set plays a while	1)	try new 35A5 tube
	2)	check bypass condensers for leakage

PHILCO 9 TRANSITONE Auto Radio

Will not tune above about 1300 kc	1)	replace 36 oscillator tube in center of line of three 36 tubes
	2)	check screen grid resistor for increased value. Replace with 20,000-ohm 1-watt unit
Weak reception	1)	remove (*grey*) 800-ohm resistor from high side to plates of tubes. To increase volume, shunt this resistor out
Noisy reception	1)	screen-grid resistor vibrating against i-f padders causing intermittent "short"

(Cont'd.

PHILCO 9 TRANSITONE Auto Radio—*(Cont'd)*

Howl	1)	dynamotor hum coming through loud howl due to "open" electrolytic condenser block on dynamotor (*Part No. 05691*)
Whistling and scraping noises when tuning stations	1)	place length of copper shield braid around rotor shaft of tuning condensers, and pull toward front end. Place ends into holes in front of condenser and solder. Shield braid must be taut

PHILCO 10

Inoperative, (no voltages, but vibrator, tubes, filter check O.K.)	1)	replace 0.01-mfd. high-voltage condenser (part *No. 30-4051*) connected across plates of 84 tube
Inoperative, (no voltages)	1)	vibrator faulty
	2)	84 tube weak
	3)	"shorted" 0.01-mfd. high-voltage condenser across plates of 84 tube (part *No. 30-4051*)
	4)	"shorted" unit in condenser block
Inoperative (fuse blows)	1)	faulty vibrator
Receiver stops playing when "self-starter" of car is engaged	1)	faulty vibrator
Intermittent reception, Fading	1)	high-resistance joint at lugs of oscillator coil. Resolder all joints carefully
Weak reception (tubes & parts check O.K.)	1)	realign i-f amplifier for maximum signal strength
Howl at high volume	1)	"open" 4-mfd. section of electrolytic condenser (*green* lead connected to r-f coil)
	2)	loose shield over 39 or 44 tube
Distortion	1)	weak 75 tube
Hum when station is being received only	1)	replace 6A7 tube
Set plays louder if car motor is raced	1)	faulty vibrator
Noisy when set is "jarred"	1)	check all coil shields for solid contact with chassis Also check coil bracket supports for the same condition. Keep chassis right side up when doing this work. Run soldering iron over joints
Setting dial correctly without loosening dial shaft screws and re-setting	1)	insert a matchstick in a hole in back of dial assembly. This disengages teeth of dial wheel so that the condensers may be turned without moving the dial

PHILCO TP-10

Inoperative	1)	clean and tighten (or replace) 7A8 tube loktal socket if any oscillator tube pins fail to contact the socket prongs

PHILCO 11

See also Case Histories for Philco 10 receiver

Fuses blow (vibrator tests O.K.)	1)	short-circuit between speaker field housing and "on-off" switch mounted on volume control. Tape field section close to volume control and place insulating material around switch
"Roar" which drowns out all signals	1)	if the noise disappears when the covers are removed to check the receiver, look over the covers and you will find a paper sheet pasted on the under side. If any part of this is unglued so that it can come in contact with the parts in the set it will cause this trouble. Reglue
Noise, unstability	1)	weakened springs holding two transformer cans in center of chassis. Put a soldering lug under the nut on top of each can and bond them to ground with a flexible stranded wire at same point where variable condenser is grounded
Tone and performance improvement	1)	replace the 0.05-mfd. tone condenser with a 0.01-mfd. unit

PHILCO 12X

High-pitched whistle, Distortion	1)	"shorten" twisted speaker leads running from speaker plug socket to plates of output tubes. Keep these leads free from third r-f primary compensating condenser

PHILCO 14 (Codes 122-123)

Inoperative	1)	open-circuited shadowgraph
	2)	check condenser *No. 12* (0.05-mfd.) connected from r-f and oscillator plate return to ground
	3)	check condenser *No. 44* (0.01-mfd.) connected from first a-f screen grid to ground for "short"
	4)	check condensers *No. 41*, electrolytic filter block (1-mfd.—1-mfd.—2-mfd.) for breakdown (indicated by narrow shadow on tuning meter)
	5)	check condenser *No. 20* (0.05-mfd.—0.15-mfd.) connected from i-f cathode to ground and from filter resistor of grid No. 2 of 6A7 tube to ground
	6)	check oscillator transformer *No. 16* for "short" between windings
	7)	check for open primary in input transformer *No. 45*
Intermittent reception	1)	snapped coil leads at lugs of oscillator coil
	2)	replace condenser *No. 38* (0.00011-mfd.) from plate of first a-f tube to ground, and 0.015-mfd. coupling condenser from first a-f tube plate to grid of driver. Replace condenser *No. 34*, (0.09-mfd.) from center-tap of volume control to grid of first a-f tube. (It is best to replace these condensers even though they may test O.K.)
Distortion at low volume	1)	"leakage" in condenser *No. 38* (0.00011-mfd.) from first a-f tube plate to ground, and in 0.015-mfd. condenser from plate of first i-f tube to grid of driver
	2)	if accompanied by hum, check condenser *No. 57* (10-mfd. electrolytic) from high voltage center-tap to ground
Distortion at high volume, "Tinny" signal, "Frying" noise	1)	check condenser *No. 41*. (1-mfd.—1-mfd.—2-mfd. electrolytic) for breakdown
	2)	check primary of input transformer *No. 45* for breakdown (indicated by "frying" noise)
Hum	1)	check condenser *No. 54* (capacity 0.25-mfd.) across filter choke for breakdown

PHILCO 14 (Codes 221-222)

Inoperative	1)	open-circuited shadowgraph
	2)	check condensers *No. 13* (twin 0.05-mfd.) for breakdown. One from tuning meter to ground, the other from i-f, AVC load resistor to ground. Indicated by wide tuning meter shadow
	3)	check filter condenser block *No. 29* for breakdown. Capacity 1-mfd.—0.25-mfd.—0.25-mfd.
	4)	check condenser *No. 27*, 0.01-mfd. from primary of first i-f coil to ground for "short"
	5)	check primary of input transformer *No. 45* for "open"
Inoperative at high or low frequencies	1)	poor type '36 tube
	2)	reduce value of detector-oscillator cathode bias resistor to 10,000 ohms
	3)	replace oscillator transformer *No. 19*
	4)	replace i-f transformer *No. 25*
Intermittent reception	1)	snapped coil leads at lugs of oscillator coil
	2)	replace first and second audio coupling condensers *No. 37* and *No. 42* (capacity 0.01-mfd.) Testing may not show any defects. If further trouble is encountered, replace all bakelite-encased by-pass condensers
Distortion	1)	check for "leaky" second audio condenser *No. 42* (0.01-mfd.)
Distortion at high volume, "Tinny" weak signal, "Frying" noise	1)	check filter condenser block *No. 29* (1-mfd.—0.25-mfd.—0.25-mfd.) for "open"
	2)	check input transformer for leakage (indicated by "frying" noise)
Hum	1)	check condenser *No. 56* (twin 0.09-mfd. across filter choke) for breakdown
Whistling or squealing	1)	compensating condensers out of adjustment
	2)	move all leads adjacent to oscillator coil further away from it
	3)	check condensers *No. 6* (twin 0.05-mfd.) connected from screen grids to ground and from r-f AVC resistor to ground for "open"
	4)	check antenna coil compensating condenser *No. 8* for "open"
	5)	check condensers *No. 13* (twin 0.05-mfd.) from tuning meter to ground for "open"
	6)	check filter block *No. 29* (1-mfd.—0.25-mfd.—0.25-mfd.) for "open"
	7)	realign i-f amplifier at 240 kc

PHILCO 14X, 14LZX

Inoperative at high or low frequencies	1)	poor type '36 tube
	2)	reduce value of detector-oscillator cathode bias resistor. If receiver contains a 15,000-ohm unit, replace it with 10,000 ohms. If receiver already contains a 10,000-ohm unit, replace it with one of 7,500 ohms
Inoperative (shadowgraph does not operate)	1)	failure or "open" circuit in shadowgraph (connected in "B"-plus circuit of the r-f and i-f tubes
Intermittent reception	1)	snapped coil leads at lugs of oscillator coil
Insufficient shadowgraph action	1)	small antenna. Increase size of antenna
	2)	weak type '44 tubes in r-f and i-f stages
	3)	increase value of diode detector secondary-return resistor

(Cont'd)

PHILCO 14X, 14LZX—*(Cont'd)*

Shadowgraph inoperative on local stations	1)	receiver circuits out of alignment
	2)	defective type '6A7 tube
No control of tone	1)	check type '37 tube in first audio stage
Signal drift (due to dial-creeping)	1)	after set is turned on, the tuning of the station "creeps" for as long as 30 to 60 minutes. Replace tension spring on back of gang condenser—use new type Philco spring (*part No. 77760*)
Noisy volume control (installing a new control only a temporary cure)	1)	disconnect end of control that goes to detector and from this detector lead connect a 300,000-ohm ½-watt resistor to ground. Also from this lead bridge a 0.05 or 0.06-mfd. condenser to the disconnected end of the volume control. This removes the d-c from the volume control and permits quiet operation
Motorboating sound, Hum	1)	eliminate by connecting 100,000-ohm resistor from first audio grid to chassis
Broad tuning	1)	r-f and i-f compensating condensers out of alignment
Whistling	1)	compensating condensers out of adjustment
	2)	move all leads adjacent to oscillator coil further away from it.

PHILCO CT-14 Auto Radio

Weak reception	1)	check alignment—especially of antenna section of tuning gang. To improve performance, move the lead that goes from first grid section of gang to the coil away from all other leads and the chassis

PHILCO TH-14

Modulation hum at high volume	1)	replace condenser *No. 12* with a 4-mfd. electrolytic unit

PHILCO 15

Inoperative	1)	tuning meter *No. 37* "open" (indicated by narrow shadow)
	2)	check condenser *No. 13* (0.25-mfd.) from first detector plate return to ground for breakdown
	3)	check condenser *No. 26* (0.05-mfd.) from first i-f plate return to ground for breakdown (3-mfd., 0.5-mfd., 1-0.015-mfd., and 1-1-mfd.)
	4)	check filter condenser block *No. 33*
	5)	"open" primary of input transformer *No. 56*
	6)	check *No. 25*, coupling condenser connected from oscillator plate to coil
Intermittent reception	1)	replace the 200-ohm oscillator cathode resistor and the 0.09-mfd. by-pass condenser. Use a 0.1-mfd. condenser to replace the odd-size 0.09-mfd. unit
	2)	replace coupling condensers *No. 44* and *No. 49* (0.01-mfd. each) in first and second a-f stages. Although these condensers may test O.K. it is best to replace them

(Cont'd)

PHILCO 15—*(Cont'd)*

istortion, Veak, "tinny" at high volume	1)	connect a 0.25-meg. resistor across the normal volume control, and a 0.002-mfd. condenser between the plates of the power tubes
	2)	check condensers *No. 48* (twin 0.25-mfd.) for breakdown. Common ground. One goes to filter resistor of first audio plate supply, the other to filter resistor of all audio grid biases
	3)	breakdown in filter condenser block *No. 33* between sections. Capacities 3—0.5-mfd., 1—0.015-mfd., 1—1-mfd.
	4)	check push-pull input transformer *No. 56* for breakdown (indicated by "frying" noise)
udio whistle	1)	replace both '47 push-pull output tubes
quealing, oise	1)	check for loose shield cans on r-f and i-f transformers
quealing (intermittent and steady)	1)	replace condenser *No. 12* (0.09-mfd. condenser) from screens to ground. Condenser may test O.K. but may be intermittently "open"
	2)	replace condenser *No. 13*, (0.25-mfd.) from first detector plate returns to ground. Condenser may test O.K. but may be intermittently "open"
	3)	replace condenser *No. 31* (0.05-mfd.) from first i-f AVC filter resistor to ground. Condenser may test O.K. but may be intermittently "open"
	4)	replace condenser *No. 26* (0.05-mfd.) first i-f plate return to ground. Condenser may test O.K. but may be intermittently "open"
o zero volume at any setting of volume control		"open" AVC Condenser *No. 42* (0.00011-mfd.) connected from volume control to ground
Shadowgraph" does not indicate on weak signals	1)	replace first detector and i-f tubes
uning condenser slipping	1)	faulty spring used to hold drive cable under tension. Replace with improved spring (part *No. 7776*)

PHILCO PT-15

um (constant, or modulation type)	1)	check for high-resistance leakage in the bakelite insulation—for example, between tube sockets and chassis, between windings of antenna coil, etc. Dry out moisture from set by heating for several hours if necessary

PHILCO 16, 16B, 16X, 16RX—(Codes 121, 122)

operative	1)	open circuit in tuning meter *No. 43*
	2)	check condenser block *No. 62*. Common goes to can; condenser *A* (2-mfd.) to oscillator plate filter resistor; condenser *B* to tuning meter; condenser *C* (0.5-mfd.) to first a-f plate supply filter resistor; condenser *D* (0.5-mfd.) to screen supply of first a-f tube; condenser *E* (1-mfd.) to screen grid supply of first detector and i-f tubes
	3)	check condenser *No. 34* (0.05-mfd.) from first detector and first i-f plate supply to ground. Faulty condenser here indicated by narrow shadow on tuning meter
	4)	check for breakdown between sections of condenser black *No. 62*. (Capacities 2—2-mfd., 2—0.5-mfd., 1—1-mfd.)

(Cont'd)

PHILCO 16, 16B, 16X, 16RX—(Codes 121, 122)—*(Cont'd)*

Inoperative (r-f dead, i-f O.K.)	1)	wire from first section of tuning condenser pulled too tight and grounding against chassis
Inoperative (no i-f)	1)	high-voltage lead (*black* wire) from i-f transformer (first facing front of chassis) grounded. This does not effect audio
	2)	compensators in top of i-f can grounded to can
Inoperative, Low sensitivity (possibly short wave reception comes in on broadcast band setting)	1)	check contacts on band switch. These contacts may shift or drop out completely. This may be indicated by short wave reception on the broadcast band, and by improper tracking of the oscillator
Inoperative at low end of short-wave band	1)	check for intermittently "open" 0.003-mfd. condenser *No. 20*
	2)	check for intermittently "open" 0.0007-mfd. condenser connected to 76 tube
Inoperative from 11 to 26 mc.	1)	replace condenser from lug 1 on bottom of waveband switch to ground marked with *orange* and *yellow* dots with one of the "lug" type (value 700-mmfd.). A poor connection internally in the pigtail condenser stops oscillation
Inoperative below 15 mc	1)	high resistance tuning condenser gang rotor contacts. Bond rotor to tuning condenser frame with flexible wire pigtails
	2)	tighten screw holding the bottom soldering lug to the tuning assembly
Inoperative at high-freq. end of broadcast band	1)	if this is due to failure of 76 oscillator to function at the high frequencies, first try a new 76 oscillator tube. If this does not help, change the 500-ohm oscillator cathode resistor to a 300-ohm unit
Intermittent reception (volume drops to very low level, no plate voltage on i-f 78 tube, and "shadowgraph" indication widens)	1)	"open" 250-ohm resistor in plate circuit of second i-f stage. This resistor is contained within the case of the small black bakelite condenser for this stage and is located adjacent to the 2nd i-f socket
Intermittent reception (shadowgraph operates normally)	1)	check 0.01-mfd. tubular audio diode-coupling condenser connected between bottom terminal of volume control and the junction of the two diode load resistors
	2)	replace volume control
	3)	faulty 78 tube (even though it checks O.K.)
	4)	replace coupling condenser *No. 59* (0.05-mfd.) connected from first a-f to second a-f tubes
	5)	check transformer *No. 46*
Intermittent reception, Low sensitivity	1)	check compensator condensers *No. 30, 39, 45* located in first, second and third i-f transformer cans. Fault may be due to loose rivets or dirt between plates. Tap cans to locate trouble, and replace assembly

(Cont'd over)

PHILCO 16, 16B, 16X, 16RX—(Codes 121, 122)—*(Cont'd)*

Bass distortion (treble harsh) (77 first det. and two i-f 78 screen voltages above normal after set warms up)	1)	check for reduction in value of 10,000-ohm resistor *No. 83* connected in network between noise potentiometer and *No. 91* 15,000-ohm resistor. Replace with 20-watt wire-wound resistor. Realign receiver
Distortion at low volume	1)	replace 0.05-mfd. first to second stage audio coupling condenser *No. 59*
	2)	check 10-mfd. electrolytic condenser *No. 75* connected from high voltage center-tap to chassis
Distortion at high volume, Weak "tinny" signal	1)	check for breakdown between sections of condenser block *No. 62* (capacities 2—2-mfd., 2—0.05-mfd., 1—1-mfd.)
Distortion and Hum	1)	check grid-bias voltage for the driver and output stages. Lack of normal bias on either of these stages usually results in the control grids of the 42 tubes glowing red (a low-emission 42 tube will produce the same result). Check for a "leaky" or "shorted" 0.15-mfd. grid filter by-pass condenser in the driver stage
	2)	if control-grid bias on 42 tubes is low or absent, check secondary return of push-pull input transformer for grounding to the case or the laminations of the transformer internally. Replace transformer
	3)	leakage of the paper which is supposed to insulate the electrolytic filter condenser from the chassis. Either one, or both, condensers must usually be replaced
	4)	"leaky" electrolytic condenser *No. 75*. Replace with new unit
Weak, choked reception (with the noise suppressor tube in or out of the circuit)	1)	check screen-grid voltage applied to 77 first a-f tube (should be approximately 50 volts). If off, replace the 1-meg. carbon resistor which supplies this voltage
How to tell difference between "fading" and "frequency drift"	1)	in all cases of "apparent fading" of signal, shift receiver tuning 5 or 10 kc plus —then minus. If this restores the signal, the trouble is not due to fading but to frequency drift which has occurred in some part of the receiver (common causes and remedies for frequency drift in various models of receivers listed further on)
Fading (condensers and resistors check O.K.)	1)	intermittent open-circuit in the third i-f transformer. Replace with new unit if defective
Fading	1)	bakelite which holds stator of oscillator tuning condenser expands or contracts, allowing set-screws and rivets to loosen. This causes stator to shift its position slightly thereby changing the oscillator frequency. Remove gang condenser and tighten all set-screws and rivets. Realign receiver
Intermittent fading	1)	secondary of first r-f transformer has high-resistance connection

(Cont'd)

PHILCO 16, 16B, 16X, 16RX—(Codes 121, 122)—*(Cont'd)*

Fading on short-wave bands Oscillator drift	1)	variable tuning condenser imperfectly grounded to chassis. Bond condenser frame to chassis with heavy flexible pigtails which will not interfere with "floating" mounting
	2)	clean the rotor-shaft contacts
	3)	tighten all screws on gang condenser and between gang condenser and chassis
	4)	waveband switch not grounded perfectly. Ground frame of waveband switch to chassis with pigtails
	5)	replace fibre insulator on high-frequency compensating condenser with new and thicker type
Frequency drift (due to i-f drift)	1)	in order to alleviate frequency drift it is recommended that the first and second i-f transformers be replaced with pair *No. 32-1186*, using compensating condenser assemblies (Part *No. 31-6030*) with shunt condensers, (Part *No. 30-1036*) connected across both the primary and secondary sections. The third i-f transformer should be replaced with Part *No. 31-1866* using compensating condenser assembly (Part *No. 31-6003*) no shunt condensers being used
Frequency drift (due to dial-creeping)	1)	replace tension spring on back of gang condenser —using improved Part *No. 77760*
Volume uncontrolled	1)	if at zero volume control setting and with the QAVC switch in the S position the volume does not reach minimum or zero, replace the 0.02-mfd. condenser in the 78 QAVC control-grid circuit with a 0.01-mfd. condenser
Code interference	1)	readjust wave trap for minimum interference. In extreme cases, reduce the i-f to a lower value—say 440 kc. The high and low frequency compensating condensers of the oscillator circuit should be readjusted in order to reproduce the correct i-f
Whistling or squealing (intermittently or steady)	1)	if accompanied by image signal check 0.05-mfd. condenser *No. 15* for "open." Connected from first detector grid return to ground
	2)	check 0.05-mfd. condenser *No. 48* from second i-f plate supply filter resistor to ground
	3)	solder pigtails from all r-f, i-f and oscillator transformer shield cans to ground
	4)	replace loose tuning meter bracket
Hum (in early series)	1)	replace the a-c switch jumper from switch through terminal lug mounted on condenser at back of set with shielded wire (with the shield grounded)
Hum	1)	check for "open" 0.3-mfd. condenser *No. 86* connected across filter choke
Tone improvement (early models)	1)	connect a 0.006-mfd. 400-volt tubular condenser from the 77 tube plate to the tone-control connection
Two resonance peaks indicated on shadowgraph, Widening of shadow upon resonance	1)	replace shadowgraph with improved part number *45-2028*

(Cont'd

PHILCO 16, 16B, 16X, 16RX—(Codes 121, 122)—*(Cont'd)*

hoked	1)	open-circuited 2-mfd. by-pass condenser *B* in condenser block
	2)	open-circuited 0.5-mfd. first audio plate by-pass condenser
oisy reception	1)	defective shadowgraph bracket. Replace
otorboating sound (steady or intermittent)	1)	check for "open" section in condenser block *No. 62* (capacities 2-2-mfd., 2-0.05-mfd., 1-1-mfd.)

PHILCO 16, 16-X, 16-RX (Code 123)

ee also the Case Histories listed for Philco 16 (Codes 121 and 122) receivers

noperative on S-W band	1)	high-resistance contacts in waveband switch. Replace wtih new switch
ntermittent reception	1)	intermittent connection between coil lead and hook-up wire in third i-f transformer

PHILCO 16, 16B, 16X (Codes 125, 126)

noperative	1)	replace 0.05-mfd. condenser *No. 22* connected from filter resistor of r-f amplifier plate supply to ground (open shadow on tuning meter)
	2)	replace twin 0.05-mfd. condensers *No. 25* connected from each side of shadowgraph to ground (open shadow on tuning meter)
	3)	check 1-mfd. condenser *No. 73* connected from screen grid of 77 first audio tube to ground
	4)	check 0.05-mfd. condenser *No. 58* connected from filter resistor of second i-f plate supply to ground
	5)	check 0.25-mfd. condenser *No. 82* connected from filter resistor of first audio plate supply to ground
noperative, Weak reception	1)	check contacts on band switch. These contacts may shift or drop out completely. (This condition may be indicated by short wave reception coming in on the broadcast band setting, and by improper tracking of the oscillator)
Weak reception	1)	check 0.003-mfd. condenser *No. 11* connected from avc load resistor of first r-f tube to ground. Breakdown indicated by inability to peak on broadcast band padder
	2)	check for "gassy" 5Z3 tube
Weak reception (intermittently)	1)	check compensating condensers *No. 43* (first i-f primary), *No. 49* (second i-f primary), *No. 55* (third i-f primary). Tapping the i-f transformer cans will usually indicate intermittent condenser. Replace faulty one
Weak reception, o plate voltage on second i-f tube, ide shadowgraph indication	1)	open-circuited 500-ohm wire-wound pigtail type second i-f tube cathode bias resistor
ntermittent reception, ery weak signals (shadowgraph operates)	1)	open-circuiting 0.05-mfd. condenser connected between the junction of the two diode load resistors and the bottom lug of the volume control
	2)	open-circuiting by-pass condenser. Trouble in lead contacts
	3)	open-circuiting 250-ohm resistor assembly blocks in i-f plate circuit

(Cont'd)

PHILCO 16, 16B, 16X (Codes 125, 126)—*(Cont'd)*

Distorted, Intermittent reception	1)	open-circuiting, or change of resistance of first audio tube 1-megohm screen resistor
	2)	replace 0.05-mfd. coupling condenser *No. 75* connected between first and second audio tubes
Distortion at low volume	1)	breakdown in 0.05-mfd. coupling condenser *No. 75* connected between first and second audio stages
Distortion at high volume, Weak "tinny" signals	1)	"open" 0.25-mfd. filter condenser *No. 82* connected in plate supply circuit of 77 first audio amplifier
Distortion (grids of 42 tubes get red hot)	1)	center-tap of push-pull input transformer grounded to core or can (Insulate from chassis with insulating bushings and washers)
Distortion (screens of 42 tubes get red hot)	1)	leakage between insulation and chassis of first filter condenser
Whistling or squealing	1)	insert a 700-ohm 1-watt carbon resistor in series with the plate lead of the 78 r-f tube, and remove the condenser shown in the circuit diagram as *No. 2A*
	2)	check for "open" twin 0.05-mfd. condensers *No. 25*. These are connected with their "common" to ground, one to each side of tuning meter
	3)	check twin 0.0001-mfd. condensers *No. 61*. These are connected with their "common" to ground, one on each side of the second detector grid return load resistor
	4)	solder pigtails from coil-mounting screws of r-f, oscillator and i-f transformer shield cans to ground
Motorboating sound	1)	check electrolytic condenser block *No. 73, red, blue* and *blue* 1-mfd. each, *plain* 2-mfd. Common negative connects to can
Hum	1)	check for "open" 0.3-mfd. condenser *No. 97*, connected across filter choke
Hum (intermittently)	1)	check for "open" 8-mfd. electrolytic filter condenser *No. 91*
Dial sticks, Dial slips	1)	excessive pressure exerted by felt rests against dial
	2)	dial cable worn or frayed

PHILCO TH-16

Carrier hum at high volume	1)	replace condenser *No. 12* with a 4-mfd. electrolytic unit

PHILCO 17

See also Case Histories listed for Philco 16

Inoperative	1)	check for "shorted" 0.05-mfd. condenser *No. 21* connected from oscillator screen grid to ground
	2)	"open" tuning meter *No. 29* (indicated by narrow shadow)
Inoperative with volume control at minimum setting and QAVC switch at "on"	1)	replace condenser *6* (circuit diagram) with a 0.01-mfd—0.002-mfd. unit

(Cont'd over)

PHILCO 17—*(Cont'd)*

Intermittent reception, Distortion	1)	check for "open" first audio screen resistor
	2)	check for increased value in first audio screen resistor
	3)	check for faulty by-pass condenser in grid-return of oscillator coil
	4)	check for faulty r-f transformer
Intermittent reception, Choking	1)	check the 2-mfd. section of the filter condenser block by-passing large 7,500-ohm wire-wound bleeder resistor
	2)	check the 0.5-mfd. condenser units by-passing the 70,000-ohm resistor in the 1st audio plate circuit. They are marked B and C, respectively
Weak reception	1)	gassy type '5Z3 tube
Choked, Distorted reception	1)	1-meg. carbon resistor in the plate and screen-grid circuits of the silencing and 1st a-f tubes has increased in value, thus lowering the screen-grid voltage of 1st a-f tube almost to the cut-off point
Distortion, Hum (control-grids of output 42 tubes glow red)	1)	secondary return of push-pull input transformer grounded to metal case or laminations internally
	2)	leakage between electrolytic filter condenser cans and chassis—due to seepage and formation of oxides at the bases of the condensers
Hum (strong and steady)	1)	check for "open" condenser connected across speaker field
Whistling (intermittent or steady)	1)	check for "open" 0.05-mfd. condenser *No. 21* connected from oscillator screen grid to ground
Apparent "fading" due to frequency drift in receiver	1)	check for loose rivets which hold the bakelite insulating panels in the sides of the tuning condenser sections, permitting the stators to shift

PHILCO 17-X

Distortion, Type '42 screens get red hot	1)	1st filter condenser leakage between insulation and chassis
Hum (strong and steady)	1)	check for "open" condenser connected across speaker field

PHILCO 18 (Codes 122, 123)

Inoperative	1)	control grid of type '75 tube shorting to shield can
	2)	open-circuited audio coupling-condenser
	3)	"shorted" tone control condenser
	4)	check first i-f primary for "open" or high-resistance joints
	5)	check AVC coupling condenser for "open" or "intermittent" joint
	6)	check for "shorted" 0.05-mfd. condenser *No. 12* connected from tuning to ground (wide shadow)
	7)	check for "shorted" electrolytic filter condenser *No. 40* (capacities 2-1-mfd., 1-2-mfd. (narrow shadow)
	8)	check for "open" tuning meter *No. 63* (narrow shadow)
	9)	check for "shorted" 0.05-mfd. condenser *No. 20* connected from 6A7 tube space charge grid supply filter resistor to ground
	10)	check for "shorted" 0.006-mfd. condenser *No. 42* connected from plate of 42 first i-f tube to ground
	11)	check for "open" primary in input transformer *No. 43*

(Cont'd)

PHILCO 18 (Codes 122, 123)—*(Cont'd)*

Inoperative, Shadowgraph insensitive	1)	short-circuited trimmer condensers. Insert larger insulating washers after bending up plates
Inoperative on short-waves only	1)	check for poor contacts in waveband switch
Intermittent reception	1)	leaky AVC coupling condenser
	2)	broken wire connection in bakelite case of coupling condenser making intermittent contact. Replace condenser
	3)	open-circuiting first i-f transformer primary winding
	4)	faulty 0.05-mfd. grid-return by-pass condenser for 78 r-f tube
	5)	faulty 0.05-mfd. grid-return by-pass condenser for 6A7 tube (in same dual-unit case with condenser mentioned above
	6)	faulty 0.05-mfd. condenser connected between chassis and one end of primary winding which in turn connects to one plate of 78 r-f tube
	7)	replace 0.015-mfd. coupling condenser *No. 37*, connected from plate of second detector to grid of 42 first audio amplifier tube. May test O.K., but may be still intermittent
	8)	check i-f transformer *No. 23*. Inspect for bad connection where coil wires are soldered to leads. May test O.K., but resolder
	9)	replace 0.01-mfd. condenser *No. 33* connected from center-tap of volume control to control grid of 75 tube
	10)	replace condensers number 30 (*3903T*) and number 27 (*3903AB*). They can be bridged with a 0.5-mfd. 600-volt unit
Whistling over entire dial (removing 78 i-f tube grid cap restores operation to normal)	1)	connect a 0.005-mfd. 300-volt condenser from center lugs of *No. 3615AA* narrow bakelite condenser to ground
Whistling (intermittently)	1)	check for "open" sections in filter condenser block *No. 40*. (capacities: 2-1 mfd., 1-2 mfd.) (motorboating)
	2)	check for "open" 0.05-mfd. condenser *No. 12* connected from tuning meter to ground
	3)	check 0.05-mfd. condenser *No. 16* connected from avc load resistor of first r-f tube to ground
Distortion at low volume	1)	check for "leaky" 0.015-mfd. coupling condenser *No. 37* connected from plate of 75 tube to control grid of 42 tube
	2)	check 10-mfd. electrolytic condenser *No. 55*, for breakdown from center-tap of high voltage winding to ground. (accompanied by hum)
Distortion at high volume, "Tinny" reproduction	1)	check for breakdown in filter condenser block *No. 40* (capacities: 2-1 mfd. 1-2 mfd.)
	2)	check input transformer *No. 43* primary for breakdown accompanied by "frying" noise)
Distorted reproduction, No power tube bias	1)	center tap of push-pull input transformer grounded to core or can. Insulate transformer from chassis with fibre washers and bushings
Mechanical hum	1)	loose, vibrating laminations of power transformer. Tap core with a hammer to test for decrease in hum
Hum	1)	check 0.25-mfd. condenser *No. 52* connected across filter choke

PHILCO 18 (Code 124)

Inoperative	1)	"open" primary in input transformer *No. 45*
	2)	"shorted" 0.05-mfd. condenser *No. 20* connected from tuning meter to ground (wide shadow)
	3)	"open" tuning meter *No. 36*
	4)	"shorted" electrolytic filter condenser *No. 40* (capacities: 2-1 mfd. 1-2 mfd.)
	5)	"shorted" 0.006-mfd. condenser *No. 44* connected from plate of driver to ground
	6)	"shorted" 0.05-mfd. condenser *No. 18* connected from 6A7 tube space charge grid supply filter resistor to ground
	7)	"shorted" electrolytic filter condensers *No. 59*, connected with "common" to high-voltage center-tap, 10-mfd. to ground, 8-mfd. to filter choke
Intermittent reception	1)	replace coupling condensers *No. 42* and *43* (0.01-mfd. from center-tap of volume control to control-grid of 75 tube; 0.015-mfd. from plate of 75 tube to grid of 42 tube. Condensers may test O.K. but may be intermittently "open")
	2)	check i-f transformer *No. 23*. Inspect for bad connections where coil wires are soldered to leads. May test O.K., but resolder
Whistling (intermittent or steady)	1)	"open" section in electrolytic filter block *No. 40* (capacities 2-1 mfd., 1-2 mfd. "common" to can)
	2)	"open" 0.05-mfd. condenser *No. 6* connected from 2-megohm avc load resistor to ground
	3)	"open" 0.05-mfd. condenser *No. 20* connected from tuning meter to ground
Distortion at low volume	1)	check 0.015-mfd. coupling condenser *No. 43* for "leakage." Connected between first audio and driver
Distortion at high volume, Weak "tinny" signals	1)	check electrolytic filter condensers *No. 40* for breakdown (capacity; 2-1 mfd., 1-2 mfd.)
	2)	breakdown in input transformer *No. 45* (accompanied by "frying" noise)
Hum	1)	breakdown in 0.25-mfd. condenser *No. 51* connected across filter choke
	2)	check electrolytic filter block *No. 59* for "open" (capacities 8-mfd., 10-mfd., "common" to high-voltage center-tap)
Hum (intermittent)	1)	check condenser *No. 59* (8-mfd. and 10-mfd. electrolytics)

PHILCO 19 (Code 121, 122, 123)

Inoperative (completely)	1)	replace type '36 oscillator tube
	2)	change first det.-oscill. cathode-bias resistor from 15,000-ohms to 8,000-ohms
	3)	"open" shadowgraph (narrow shadow)
	4)	check for "short" in condenser block *No. 7* capacities: 2-0.09 mfd., 2-0.05 mfd., 1-0.25 mfd.)
	5)	check for "short" in condenser *No. 8* (capacities: 0.09-mfd. and 0.0007-mfd.) connected from cathode bias resistor of oscillator to ground, and from avc load resistor to ground. (In later models using a 77 det.-osc. tube, the value of the 0.0007-mfd. condenser has been increased to 0.0014-mfd.)
	6)	check for "shorted" 0.05-mfd. condenser *No. 45* connected across speaker field
	7)	check for "snapped" leads at lugs of oscillator coil

(Cont'd)

PHILCO 19 (Code 121, 122, 123)—*(Cont'd)*

Inoperative (completely) —*(Cont'd)*	8)	if voltages check O.K., check the 15,000-ohm ½-watt resistor on resistor and condenser block for change in value. Replace with 1-watt unit
Inoperative (only motorboating sound heard)	1)	check i-f transformer *No. 23* for "short" between windings—usually where leads from one coil pass over other winding. (*"Positive"* voltage on the control-grid or the cathode of the i-f tube indicates presence of this condition)
Inoperative over part of band	1)	replace 36 det.-osc. tube. If this does not help, try changing value of oscill. cathode bias resistor from 15,000 ohms to 10,000 or 7,500 ohms
	2)	check compensating condenser *No. 15* (on oscillator transformer) for dampness. Replace any extremely thin or cracked mica in it
	3)	subject tuning condenser assembly and associated padders to heat (moisture absorption in mica insulation of padders and fibre insulating supports of plates and padders may be causing the trouble.) Replace fibre washers in compensating condensers with new bakelite washer and metal washer on top (Philco Parts *No. 27-4109* and *W-1331*). Examine oscillator tuning section stator for loose contacts
	4)	change first i-f compensating condensers to new type Philco Part *No. 31-6016*
	5)	wire from oscillator tuning condenser to oscillator coil should be rubber-covered
	6)	re-impregnate oscillator coil, dip entire coil in hot paraffin for twenty seconds—leaving only a portion of the mounting lug undipped, to assure a good ground connection. Allow both the coil and the pot of paraffin to cool until the paraffin becomes of somewhat heavier constituency, when the coil should be dipped again to give it a fairly heavy coating
	7)	in extreme cases replace det.-osc. socket
Intermittent reception	1)	check i-f transformer *No. 18* for "open" —especially at points where coil leads and external leads are soldere dtogether
	2)	imperfect connections at oscillator coil or at tuning condenser stators. Also see if screws holding stator plates are loose. Tighten screws in oscillator condenser stator
	3)	if all voltages are O.K. when set cuts in and out, replace condensers number 30 (*3903T*) and number 27 (*3903AB*). They can be bridged with a 0.5-mfd. 600-volt unit
	4)	if intermittent operation changes to normal when line switch is cut on and off, resolder oscillator cathode by-pass condenser connections
Weak reception	1)	remove 5,000-ohm resistor from the r-f plate lead
Distortion at resonance peak of station	1)	check resistor *No. 43* for partial "open"
Distortion at high volume, Weak or "tinny" signal	1)	check condenser block *No. 7* for "short" in one or more sections
Whistling or squealing	1)	check for "open" condenser sections in condenser blocks *No. 7* and *No. 8*
Shadowgraph inoperative, but receiver operates	1)	"shorted" shadowgraph. Replace

(Cont'd over)

PHILCO 19 (Code 121, 122, 123)—*(Cont'd)*

Shadow on shadowgraph widens	1)	snapped lugs at oscillator coil leads
Wide shadow on shadowgraph	1)	insufficient antenna (connect 2,000-ohm resistor across shadowgraph)
Insufficient action	2)	remove shadowgraph from i-f plate circuit
Intermittent operation of shadowgraph	1)	intermittently open-circuiting shadowgraph coil. Replacement is necessary
Hum	1)	dried-up electrolytic condensers. Replace with new units

PHILCO 19 (Code 128)

Inoperative	1)	check for "shorted" condensers *No. 29* and *No. 38* (breakdown indicated by narrow tuning meter shadow)
	2)	check for "shorted" condenser *No. 59* (indicated by wide tuning meter shadow)
	3)	check for "shorted" condensers *No. 18* and *No. 31*
	4)	check i-f transformer *No. 21* for "short" between windings. (indicated by motorboating sound)
Inoperative over part of band	1)	see remedies for this trouble listed under Model 19 (Codes 121, 122, 123) receiver
Intermittent reception	1)	check for poor connections where coil leads of i-f transformer *No. 16* are soldered to external leads
Distortion at resonance peak of station	1)	check for partial "open" in resistor *No. 52*
Distortion at low volume	1)	check for "shorted" condenser *No. 26*
Distortion at high volume, Weak "tinny" signal	1)	check for "shorted" condensers *No. 31* and *No. 29*
	2)	check for "shorted" condenser *No. 26*
Hum	1)	check for "open" condenser *No. 29*

PHILCO 20, 20-A, 21

Inoperative	1)	if there is no voltage on the '24 detector tube, check for "open" in field coil. This may often be repaired by resoldering the lead at the point where it attaches to the fine wire of the coil
	2)	check for "open" primary in output transformer *No. 28*
	3)	check for "open" primary in input transformer *No. 21*
	4)	check choke *No. 27* for "open," and for "ground" (latter condition indicated by overheated rectifier tube)
	5)	check condenser *No. 26* for "short" (indicated by overheated rectifier tube)
	6)	check condensers *No. 6* and *No. 8* for "short"
	7)	check 200-ohm 2-watt cathode bias resistor for 24A detector tube
Weak reception	1)	if all voltages check O.K. suspect an "open" blocking condenser in resistance-coupled a-f stage
	2)	bias section of volume control is often responsible for this trouble. Replace if its resistance is found to be practically zero. Replace the entire volume control if possible. Otherwise, connect a 1,000-ohm resistor in series with the "plus" end of the volume control
Intermittent reception	1)	if all voltages check O.K. and snapping the light switch brings back signal, try replacing the 0.01-mfd. coupling condenser between detector and 1st audio tubes
	2)	check all condensers in the bakelite cases—it is well to replace all of them
	3)	lack of 1st a-f plate voltage (intermittently) is caused by faulty primary winding of push-pull input transformer
Whistling or squealing	1)	open-circuited r-f plate and by-pass condensers (connecting leads snap at lugs or within case)
	2)	open-circuited first audio coupling-condensers (connecting leads snap at lugs or within case)
	3)	connect a large mica condenser in the detector plate circuit
	4)	solder pigtails from the condenser gang rotor shaft to chassis
	5)	place drops of mineral oil on the condenser gang bearings
	6)	if all by-pass condensers and voltages check O.K., connect a 0.5-mfd. condenser from the centertap of the '71A filament winding to ground
	7)	try connecting a 0.01-mfd. 600-volt paper condenser between the chassis and the power transformer terminal to which the power line cord is attached directly. On some receivers, a larger capacity is needed. This also reduces hum
	8)	a 0.05-mfd. condenser connected from the heater of one of the '24A tubes to chassis often cures oscillation present when the station is being tuned in
High-pitched whistle at high volume levels	1)	place a 4-mfd. filter condenser between the yellow terminal of the condenser block connected to the high voltage side of the voltage-divider system and ground
Whistling or squealing accompanied by Fading, Noisy reception (tubes and voltages test O.K.)	1)	defective volume control resistor. Replace with a new unit
Distortion, "Mushy" noise	1)	intermittent fluctuation in value of 500,000-ohm grid leak resistor in the type '27 tube grid circuit. Replace
Distortion at low volume	1)	interchange detector tube with one of the r-f tubes
Distortion at high volume, Weak, "tinny" signal	1)	faulty input push-pull transformer. If set is weak but there is no distortion, check the condensers in the black cases
	2)	check the coupling condensers in the audio system
	3)	replace the 0.5-meg. resistor in grid circuit of '27 tube
	4)	check primary of output transformer *No. 28* for breakdown
	5)	check for "shorted" condenser *No. 14*

(Cont'd)

PHILCO 20, 20-A, 21—*(Cont'd)*

Crackling and popping noises	1)	noisy primary in push-pull input or output transformers
	2)	if jarring the set produces change in the noise, check the coil shields for solid mechanical and electrical contact
	3)	if noisy while tuning, see if the full-floating mounting of the tuning system is causing the pilot light mounting to ground intermittently. Insulate it
	4)	check for "grounded" filter choke (caused by wire in winding grounding to core). Rewind—or replace filter choke
Poor tone	1)	install the new type cone and spider assembly having a flexible center
	2)	receiver circuits out of alignment
Carrier hum	1)	poor connection of the B-supply connecting wire. It is on the end of the condenser block opposite to the leads. The block must be heated and the condenser assembly removed to make repairs
	2)	check for "open" section in condenser *No. 26*
Hum (steady, or intermittent)	1)	check for "open" condenser *No. 26*
	2)	faulty filter condenser
	3)	add an 8-mfd. electrolytic cond. across r-f by-pass unit *No. 3615-K*. Try both terminals—(outside *positive* lug usually best)
Slipping tuning drive	1)	insufficient tension upon bearings in tuning-gang reduction gear

PHILCO 22

Same Case Histories as those listed for Philco 71 receiver

PHILCO 23

Same Case Histories as those listed for Philco 91 receiver

PHILCO 24

Same Case Histories as those listed for Philco 51 receiver

PHILCO 25

Same Case Histories as those listed for Philco 43—(AC) receiver

PHILCO PT-25 TRANSITONE Auto Radio

Noisy reception	1)	inspect rubber insulation on antenna lead where it runs through chassis. Cutting or abrasion of insulation here results in microphonic contact and noise

PHILCO 26

Same Case Histories as those listed for Philco 19 (Codes 121, 122, 123) receivers

PHILCO PT-26 TRANSITONE Auto Radio

Hum	1)	high-resistance leakage between pilot light socket and chassis. Replace
Low-frequency oscillation	1)	faulty i-f transformer. When replacing, dress the i-f leads carefully or receiver alignment difficulty will be experienced

PHILCO 27

Same Case Histories as those listed for Philco 19 (Codes 121, 122, 123) receivers

PHILCO 28 (AC-DC)

Inoperative, No plate voltage on type '75 tube	1)	"shorted" 0.25-mfd. by-pass condenser *No. 46* connected between junction of two resistors in plate circuit of 75 det.-1st a-f tube and its cathode
	2)	open-circuited resistor in type '75 tube plate circuit
	3)	"shorted" 0.1-mfd. condenser *No. 23* connected from common B-plus return line and common cathode return circuit
Inoperative (no plate voltages)	1)	check for "shorted" 6-12 mfd. dual condenser unit *No. 65* in filter circuit
	2)	check for "shorted" 6-12 mfd. dual condenser unit *No. 68* in filter circuit
No short-wave reception, Fading on local stations	1)	open or poor wave-band and switch contacts
	2)	receiver circuits out of alignment
	3)	defective tubes. Check by replacement
Intermittent reception	1)	short-circuited i-f transformer. Replace with new unit
Intermittent reception, Hum, Volume control operation difficult	1)	replace volume control
Intermittent reception, Noisy reception	1)	defective volume control. Test by pulling on shaft
	2)	loose lead from antenna post to antenna coil
	3)	intermittent connection in second i-f transformer
Weak reception (low over all plate voltages)	1)	check for "shorted" or "leaky" 6-12 mfd. dual condenser units *No. 65* and *No. 68* in filter circuit
Distortion	1)	defective speaker cone
	2)	defective type '25Z5 tube
Distorted reproduction, Weak reception, Low plate voltage on type '75 tube	1)	leaky plate by-pass condenser in plate circuit of type '75 tube
	2)	check for "shorted" or "leaky" 0.02-mfd. coupling condenser *No. 48* between 75 tube plate and 43 tube control grid
Whistling, Weak reception	1)	open-circuited first i-f tube cathode by-pass condenser
Noisy tuning, Noisy reception at high-frequency end of short-wave band	1)	oil on dial drive shaft bearings and pulley
Noisy tuning, Inoperation at some point of scale	1)	burrs or flakes on condenser gang plates. Burn with high voltage—all terminals disconnected
Noisy volume control	1)	isolate volume control from diode load circuit with condenser and complete diode circuit with additional resistor
Code interference on broadcast band	1)	wave-trap in antenna circuit out of adjustment
Slipping dial	1)	insufficient tension of roller spring at end of drive shaft
Hum	1)	test for high-resistance leakage between line-resistor and chassis. Insulate it
Modulation hum	1)	check for "open" or reduced-capacity section in 6-12 mfd. dual condenser units *No. 65* and *No. 68* in filter circuit
Motorboating sound and whistling	1)	check for "open" 0.09-mfd. by-pass condenser *No. 24*

PHILCO 29

Inoperative	1)	if rectifier tube plates get red hot, check for "shorted" section in 8-8-10 mfd. triple unit condenser *No. 64*
	2)	if tuning meter shadow is wide, check 0.05-mfd. by-pass condenser *No. 21* connected between plate-return of 6A7 tube and chassis
	3)	check 0.09-mfd. by-pass condenser *No. 22* for "short" (connected from junction of 32,000-ohm and 0.1-megohm sections of voltage divider and chassis)
	4)	check for "shorted" or "leaky" 0.05-mfd. by-pass condenser *No. 32* connected between 2nd i-f tube plate-return and chassis
	5)	check for "shorted" or "leaky" 0.25-mfd. by-pass condenser *No. 40* connected between junction of resistors in 75 tube plate circuit and chassis
	6)	check for "open" or "grounded" winding in filter choke *No. 60* (sometimes indicated by "frying" noise)
Intermittent reception	1)	check for "intermittently open" circuits in all three i-f transformers—especially at points where coil leads are soldered to external leads
Fading after short period of normal operation	1)	check 350,000-ohm volume control and replace if faulty. It often varies up to several megohms intermittently
	2)	faulty third r-f transformer. Replace with new unit
Weak reception (tone good)	1)	if there is lack of sharpness in the adjustment of the trimmer *nut* on the 2nd i-f can, check for an "open" secondary in the 2nd i-f transformer
Weak reception or intermittent signal at high-freq. end of band	1)	replace 400-ohm flexible wire-wound 1st det.-osc. tube bias resistor *No. 8* with one of 300 ohms
	2)	replace 500-ohm flexible wire-wound 1st i-f tube bias resistor with one of 400 ohms
	3)	replace 25,000-ohm oscillator circuit resistor *No. 10* with one of 45,000 ohms
	4)	replace 0.0008-mfd. mica condenser *No. 13* in oscillator circuit with one of 0.00025-mfd.
Distortion at high volume, Weak "tinny" signal	1)	check for "leaky" or "shorted" 0.25-mfd. tubular by-pass condenser *No. 40* connected from junction of two resistors in 75 tube plate circuit to chassis
	2)	check for "leaky" or "shorted" 0.02-mfd. tubular coupling condenser *No. 42* connected between 75 plate and 42 tube grid
Whistling (intermittent or steady)	1)	if motorboating sound is also heard, check for "open" 0.09-mfd. twin (bakelite block) common by-pass condenser *No. 22* for the two 39 tubes
	2)	check for "open" section in 8-8-10 mfd. electrolytic filter block *No. 64*
	3)	intermittently open-circuiting 0.1-mfd. tubular condenser connected between the i-f transformer secondary coils and ground. Replace with new unit
Audio whistle, "Bubbling" hum	1)	intermittently open-circuiting 0.09-mfd. common bias by-pass condenser for the two type '39 tubes. Replace with new unit
Hum (steady)	1)	check for "open" section in 8-8-10 mfd. electrolytic filter condenser block
Production change to improve fixed bass compensation of receiver	1)	replace 0.09-mfd. bakelite block condenser *No. 54* with a 0.05-mfd. unit

PHILCO PT-29

Whistling or squealing on high end of dial	1)	replace 47,000-ohm oscillator grid leak with a 25-000-ohm resistor

PHILCO 30

Inoperative (no screen voltage)	1)	"shorted" 0.25-mfd. condenser connected from choke to chassis. This is one section of a dual unit in a metal can near the choke terminals
Inoperative	1)	check for "open" primary in input transformer *No. 38*
	2)	check for "open" primary in output transformer *No. 41*
	3)	check for "shorted" condensers *No. 20, No. 39, No. 12*
	4)	check for "shorted" condensers *No. 21* or *No. 22*
	5)	check for "shorted" condenser *No. 11*
Intermittent operation	1)	broken flexible wire under cloth cover of grid control leads. A check from condenser to ground shows good contact, but a check from *inside* of rubber control-grid caps indicates "open". Replace all control-grid leads
	2)	check for intermittently "open" bakelite-encased condenser *No. 33*. Replace
Low volume	1)	look for high resistance in i-f coils. Replace defective coils with new units
Intermittent low volume	1)	check for intermittently "open" bakelite-encased condenser *No. 3*
	2)	check for intermittently "open" bakelite encased condenser *No. 9*
	3)	check for intermittently "open" bakelite-encased condenser *No. 15*
Fading	1)	intermittently open-circuiting 0.05-mfd. blocking condensers in the grid circuits of the r-f stages. Test by squeezing each unit and noting the effect. Replace if defective
Thin, metallic tone quality	1)	if circuit and tubes are O.K., trouble is probably due to "stiffness" of speaker cone. This may be remedied by carefully cutting out the cone between points where the screws are necessary for support. Cut slots in the apex member of the voice coil to give it greater flexibility. Three spiral slots, starting at the center and winding out near the edge will be best
	2)	check for breakdown in primary of audio input transformer *No. 38* (usually accompanied by "frying" noise)
	3)	check for breakdown of primary in audio output transformer *No. 41* (usually accompanied by "frying" noise)
Whistling or squealing	1)	check for "open" bakelite-encased by-pass condensers *No. 11, 12, 20, 21, 22* and *39*

PHILCO 32 (32-Volt Receiver)

Inoperative	1)	if motorboating sound is heard, check i-f transformer *No. 21* for "short" between windings (usually at places where leads from one winding pass along the other winding)
	2)	check vibrator to see if it is operating
	3)	if vibrator armature is overheated or burned, check for "shorted" condenser *No. 61* or *No. 64*

(Cont'd)

PHILCO 32 (32-Volt Receiver)—*(Cont'd)*

Inoperative —*(Cont'd)*	4)	if choke *No. 58* overheats, check for "grounding" in vibrator assembly
	5)	if choke *No. 60* overheats, check for "shorted" condenser *No. 50*
	6)	check for "shorted" condensers *Nos. 10, 25, 37* and *41*
Inoperative over high-freq. end of band	1)	examine oscillator transformer *No. 11* for dampness. Proceed in accordance with instructions given for this same trouble in Case History for Philco 19 (Codes 121, 122, 123) receivers
Intermittent operation	1)	check for "intermittent open" in i-f transformer *No. 19*—especially where internal coil leads are soldered to external leads
Distortion at low volume	1)	check for "open" condenser *No. 33*
Distortion at high volume, Weak "tinny" signal	1)	check for "shorted" condenser *No. 37*
	2)	check for "shorted" condenser *No. 33*
	3)	check for "shorted" condenser *No. 41*
Hum	1)	check for "open" condenser *No. 50*

PHILCO PT-33

Modulation hum	1)	connect a 0.05-mfd. condenser across pilot light terminals on line ballast resistor. Then disconnect all wires, resistors and condensers from dummy terminals, *No. 3, No. 4, No. 5,* and *No. 6* on 35Z3 tube socket. Tape these wires, and dress them away from socket

PHILCO 34

Inoperative	1)	check for "open" primary in audio input transformer *No. 49* and output transformer *No. 51*
	2)	check for "shorted" condensers *No. 6* and *No. 31*
Inoperative on broadcast band, image or s.w. signals feed through on broadcast band, Weak reception	1)	check waveband switch for missing or misplaced floating contact
Intermittent reception	1)	check for "intermittently open" i-f transformers *No. 25, No. 28,* and *No. 32*—especially at points where coil leads and external leads are soldered together
Distortion at low volume	1)	check for "shorted" condenser *No. 47*
Distortion at high volume, Weak "tinny" signal	1)	check for "shorted" condenser *No. 31*
	2)	if "frying" noise is heard, check primary of *No. 49* audio input transformer and *No. 51* output transformer
	3)	check for "shorted" condenser *No. 47*

PHILCO 35

Inoperative	1)	check for "shorted" oscillator section in tuning condenser
	2)	check for "shorted" condensers *No. 19, No. 21,* and *No. 39*
	3)	check for "open" primary in audio input transformer *No. 31*

(Cont'd)

PHILCO 35—*(Cont'd)*

Intermittent reception	1)	check for "open" bakelite-encased condensers *Nos. 4, 19* and *26*
	2)	check for loose screws holding bakelite mountings on tuning condenser
Distortion at high volume, Weak "tinny" signal	1)	if "frying" noise is heard, check for breakdown of primary windings of audio input transformer *No. 29* and output transformer *No. 31*
Noisy reception	1)	check for loose r-f and oscillator transformer shields
Microphonic	1)	replace oscillator transformer *No. 9*
Whistling or squealing	1)	check for "open" bakelite-encased bypass condensers *Nos. 4, 19, 39*

PHILCO 35-1231, 35-1233, 35-1239, 35-1241 Automatic Record Changers

Motor fails to run, even when it is entirely disconnected from all other wiring and proper voltage is applied directly to the two ends of its windings	1)	trouble in motor windings. Unless damage is easily seen and repaired, it is usually best to replace motor
Mechanism slow in starting, Motor gets hot	1)	failure to lubricate properly. Oil thoroughly. See oiling instructions given later
	2)	check voltage. Line voltage may be abnormally low or high
	3)	motor windings damaged. If windings are found damaged, replace motor
Motor slow in starting	1)	check oiling, as directed later. It may not have been properly done; old oil may have become gummy
	2)	changer may have been in a very cold place, and may not yet have reached room temperature. Give it a fair chance to get warmed up before concluding that Motor is defective
Squeaks or other noises during playing of records	1)	check oiling, as directed later. (If squeaks are heard, they will usually be found to come from the records—not from the mechanism)
Changer noisy when in "cycle"	1)	check oiling. Also see if any part has become loose or bent and is rubbing against a moving part such as the Swivel Guide Arm against the Cam Gear
Motion of pickup toward record pin will not trip changer mechanism	1)	"manual" button down. See that shipping bolts are removed. If trigger is being properly actuated, probably cam lever is binding against sub-plate. Look for dirt or obstructions; see that pawl and trigger are working freely on their rivets. If the lever engages the pawl so that lift forces roller up into the under groove on cam gear, and if set-screws are tight, the change cycle must operate as cam gear turns
Pressing "R" button does not trip changer mechanism	1)	due to shipping bolts not being removed, causing a bind on manual rod, or manual button is down.
	2)	check key control unit: see whether there is an obstruction or a bent part which prevents "R" button from going clear down to the end of its travel
	3)	examine reject rod. If it does not trip, even when properly revolved by complete depressing of "R" button, the rod has probably been bent, and must be restored in some way. Grasp the two ends and twist it slightly
	4)	if trigger is being properly actuated but without starting a change cycle, see directions under (*Motion of pickup toward record pin will not trip changer mechanism*)

(Cont'd over)

PHILCO 35-1231, 35-1233, 35-1239, 35-1241 Automatic Record Changers—*(Cont'd)*

Pressing "M" button fails to put changer mechanism out of action so as to enable manual operation	1)	first see that button goes clear down; then follow its action through Manual Rod
	2)	also caused by the manual rod being bent and not projecting up through Subplate and stopping Cam Lever when it is released from the Trigger
Trips too soon, or before record has finished playing	1)	this is caused by too little clearance between the trigger and the clutch lever assembly. To get more clearance on this adjustment, turn the adjusting screw in a clockwise direction a half-turn or whatever is necessary to make tone arm trip on ¼" motion
Tone arm falls off record	1)	needle sits down too close to edge of records, not adjusted in far enough, or needle landing adjusting cam reversed. It should contact lug on adjusting rod on the long side of cam. Check pick-up leader spring. It may have become loose; more tension can be given it by bending down lug
Tone arm sits down too far in	1)	due to adjusting rod bending and not measuring properly. If found to be bent, should be straightened to correct shape so that it will operate freely
Needle lands properly on record but fails to move over into record groove	1)	pickup arm is normally impelled toward center of records by Lead Spring. Should a slight increase in its tension be found necessary, this can be easily obtained by slightly bending the lug, to which it is attached, down against Main Plate
"Wow" in record reproduction	1)	record is warped or otherwise defective, or instrument is not being operated at normal room temperature, 70 F°
	2)	motor mounting plate being bent will cause "wow." Straighten it if possible or replace with new plate if too badly bent to warrant straightening. This is only found where rough handling is evident
	3)	motor shaft out of alignment with the turntable shaft (also due to rough handling). To correct, move the motor on its mounting until motor shaft is parallel to the turntable shaft and the Universal coupling is exactly at right angles to motor and turntable shafts, then tighten motor mounting screws securely
Last record drops on one side only	1)	this suggests a Changer Post bent out of perpendicular to Main Plate. If Post must be straightened, be careful not to bend other parts
Changer continues cycling	1)	probably due to failure of lift to be drawn back out of engagement with cam gear. Check the various rivets at which motion occurs, to find the point where friction or binding is interfering with freedom of motion.
	2)	make sure that trigger spring is not disconnected. Also that clearance between trigger and clutch lever is sufficient. A sticking pawl will also cause this condition
Record is driven, but not heard—or not heard with proper volume	1)	see that pickup cord is plugged in. Check amplifier and speaker and connections to them, thoroughly. If then trouble is still suspected in pickup, test its output with a vacuum-tube voltmeter. Playing an average record, output should test 1 to 2.5 volts if pickup cartridge is of crystal type. If pickup cartridge is found not to deliver proper output, remove it and install another.
		See Philco Service Bulletin No. 254 for Philco Photoelectric Reproducer adjustments
Records jam	1)	most slicing trouble (record jams) is due to off-size or defective records, and is no fault of the record changer or record changer adjustment. Properly manufactured records have a uniform semi-circular edge and can be successfully handled by record changers, even though the records vary considerably in thickness.
		Records that prove troublesome in the selectiing or slicing process can usually be corrected by using a piece of fine sandpaper or emery cloth to touch up the edge.

(Cont'd)

PHILCO 35-1231, 35-1233, 35-1239, 35-1241 Automatic Record Changers—*(Cont'd)*

Audio howl	1)	record changer not floating on cushions o spring mounting. See that shipping bolts ar removed. If unit still does not float, loose the nuts or mounting assembly allowing uni to rise and float
Turntable is tight	1)	this turntable is assembled to the turntabl shaft with a taper lock fit in the center. T remove, grasp turntable with both hands turn slightly forward and backward at th same time pulling upward, or run motor an grasp the turntable while it is revolving and pull up
"Thump" heard in record reproduction	1)	this is caused by the motion of the frictio clutch when it is momentarily released b the motion of the release lever, which i turn is actuated by the hump on the can gear. If thump is objectionable, it can b reduced by adjusting the clutch lever to al low only a slight amount of motion of th clutch assembly; also if the clutch spring i too strong, replace with a new spring or cu one-quarter of the length of the old spring or whatever is necessary to assure satisfac tory operation. Be sure that clutch assem bly parts are free from dirt and burrs an work freely without binding
Adjusting landing position of needle on record	1)	if needle comes down on the sound track playing of records will not start at their be ginning. Insert screw driver through hol AH. Turn screw head on needle landing ad justing cam FM very slightly *counter-clockwise* If needle comes down too close to outer edg of record, or out beyond edge of record, turn adjusting cam *clockwise*
To check oiling and to lubricate properly	1)	if squeaks are heard, compare the squeal with and without a load of records; any stack of records in motion is likely t squeak a little against a pin through the center.
		Changer should be lubricated once a yea with about a dozen drops of a good ligh machine oil at each of the following 6 points All points can be reached from above through holes in the mounting plate as fol lows:
		Nos. 1, 2, 3: Three oil holes on motor gea housing. Reach all three through two hole AI.
		No. 4: Through hole marked AJ, drop the oi upon flat surface of cam. It will distribut itself to proper points.
		No. 5: Through hole marked AM, see fel wick, and drop the oil directly upon it.
		No. 6: Through hole marked AL, see fel wick, and drop the oil directly upon it.
		See that all five wicks are in position, in cluding three ¼" round wicks in frame o motor, one washer-shaped wick on lift, an one on cam lever DI. See that each wick i thoroughly saturated (as it may not be i insufficient oil or too heavy oil has bee used). Lift out all three motor wicks, with tweezers; see if old oil has become gummy (commonly due to use of low-grade oil o low-viscosity oil). If necessary, clean gum med-up wicks with kerosene. See that eac is saturated with good oil; then, before re placing them, drop a little good oil into th holes. The gearbox of the motor is packe with a semi-fluid grease at the factory, an it should never be necessary to take it apar for lubrication purposes.

PHILCO 36

Same Case Histories as those listed for Philco 35 receiver.

PHILCO 1936 TRANSITONE Auto Radio Receivers

Intermittent reception	1)	loose antenna plug insulator preventin good contact. File long insulator to al most the level of the plug

PHILCO 1937 Receivers—(General Servicing Notes)

Inoperative	1)	"open" antenna or r-f coil. Vibration cause coil leads to snap
Inoperative (models having rectifier tube on top of transformer)	1)	check rectifier rocket for poor contact —contacts often break between the tw insulating wafers. Replace

(Cont'd

PHILCO 1937 Receivers—(General Servicing Notes)—*(Cont'd)*

Intermittent reception on broadcast band	1)	check for high-resistance joint at the connections to the trimmers or padding condensers for the broadcast band
Intermittent reception (general)	1)	leakage between high-voltage lugs and osc. grid or avc lugs of waveband switch. Replace
Burnout of hum-control potentiometer	1)	usually caused by a ground occurring in one side of filament line. This often happens by accidently touching the bracket against the chassis when changing the pilot light
Whistling, Squealing, Birdies	1)	"ground" housing of shadowgraph
Cross modulation and whistling when operating receiver near two powerful broadcasting stations	1) 2)	if broadcast frequencies of the two stations differ by an amount equal to the i-f of the receiver, realign the i-f amplifier to an i-f frequency slightly higher or lower if the condition is caused simply by tremendous power from the two stations, install a Philco loading coil (*Part No. 32-2417*) across the transmission line terminals on the back of the chassis
Intermittent noise	1)	check for loose ground terminal screw at strap connector. These are terminals 3 and 4 which are linked together by this strap connector to ground when the Philco high-efficiency aerial is attached to the terminal panel at the rear of the chassis
Noisy volume control	1)	lack of tension on the rotating arm of the control. This condition can be remedied by inserting a thin metal wire between the brass bushing and metal ring on the outside of the shaft. This will tighten the tension of the arm and eliminate the nosiy control. Place a drop of oil on it to prevent excessive wear. It is not always necessary to replace this control
Automatic tuning mechanism slipping	1)	with station properly indexed, receiver is found to be receiving a station of a frequency other than the one dialed. In practically all cases of frequency shiftnig with models equipped for automatic tuning, it has been found to be due to loose set-screws at the flexible coupling connecting the condenser drive shaft with the automatic mechanism. The earlier releases of these units had slotted-head set screws and could be tightened with a screw driver. However, the later or improved type has the Allen-head set-screws, and a special wrench (Part *No. 45-2424*) is required in order to tighten these screws securely
Distorted, fuzzy tone	1)	check voice coil gap for steel particles. They get behind the heavy cardboard spacer and gradually work into the air gap. Clean out all this foreign material

PHILCO 37 (Battery Operated)

Inoperative (no plate voltage readings)	1) 2)	check the compensating condensers, as they often touch the chassis, causing a direct "short" check the filter condensers
Inoperative	1)	check for "open" primary in input transformer *No. 36* and in output transformer *No. 38*

(Cont'd)

PHILCO 37 (Battery Operated)—*(Cont'd)*

Inoperative —*(Cont'd)*	2) 3) 4) 5)	check for "short" between primary and secondary winding of i-f transformer *No. 11* and *No. 22* check "on-off" switch for "open" check for "shorted" condenser *No. 13* check for "shorted" condenser *No. 17*
Inoperative (volume increases if finger is placed on stator of the band-pass tuning condenser)	1)	"open" antenna coil. May be remedied temporarily by clipping the antenna to the stator plates of the band-pass section of the tuning gang
Intermittent reception	1)	check for intermittently "open" bakelite-encased condenser *No. 33*
Intermittent reception over part of band	1) 2)	replace type 15 tube inspect oscillator coil *No. 10* for dampness. Dry out, or replace
Whistling or squealing	1) 2) 3) 4)	clean "grounding" contacts on tuning condenser rotors check for "open" sections in condenser *No. 13* check for "open" in "on-off" switch check for "open" bakelite-encased condensers *No. 17* and *No. 24*
Distortion at high volume, Weak, "tinny" signal	1) 2)	if "frying" noise is heard, check for breakdown in insulation of primary windings of input transformer *No. 36* and output transformer *No. 38* check for "open" condenser *No. 13*

PHILCO 37-9 (Code 121)

Inoperative	1) 2) 3) 4) 5) 6)	check for broken leads between coils and waveband switch (especially the fine wires from the primaries), and where leads from tuning condenser stators run through chassis to connect to waveband switch check for "short" between segments in waveband switch check for "short" in audio shorting switch, due to fibre plunger on index handle assembly breaking, or wear or breakage of insulating sleeve. Removing retaining springs and dial assembly will expose these for inspection check for "open" oscillator transformer winding check for "open" condensers *Nos. 34, 45X, 81* and *85* if rectifier tube overheats, check for breakdown in a section of filter condenser *No. 70*
Intermittent reception	1)	check for intermittently "open" condenser *No. 86*
No magnetic tuning action	1) 2)	check for "open" transformer *No. 29* check for "shorted" automatic magnetic tuning switch *No. 37*
Frequency drift (station can be brought back by retuning receiver)	1) 2)	tighten set-screws on tuning condenser drive assembly replace tuning condenser drive coupling buckle
Weak reception	1)	See *Note (F)* and *Note (G)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

(Cont'd over)

PHILCO 37-9 (Code 121)—*(Cont'd)*

Weak reception—*(Cont'd)*	2)	if no padding peak can be obtained, check for "open" resonance circuit in i-f transformer *No. 43*
	3)	check for "open" primary in r-f transformer *No. 8*
Weak reception and distortion (both get worse when one of the 6F6G tubes is removed)	1)	check for "open" 0.01-mfd. condenser *No. 84* connected between the control-grid and screen-grid of output tubes. Replace with a 600-volt unit
Distortion at resonance peak of station	1)	rebalance No. 2 i-f stage
Distortion at minimum volume	1)	dress the *green-and-white* wire connecting the volume control *No. 67* center lug to the automatic tuning dial audio switch *No. 93* away from compensator *No. 54* and the diode circuit of the second detector and first audio type 6Q7G tube. Numbers referred to are to be found on the schematic circuit diagram
	2)	check for "shorted" condenser *No. 86*
Whistling or squealing	1)	check for "open" condenser *No. 6*
	2)	check for "open" condenser *No. 11*
Hum	1)	check for "open" condenser *No. 70*
Dial trouble	1)	see *Note* (*K*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
To improve i-f circuit operation in Run #1 receivers	1)	connect a 0.1-mfd. condenser (Part *No. 30-4455*) from *red* primary lead of i-f i-f transformer *No. 53* to ground

PHILCO 37-9X

Distortion on powerful local stations	1)	discriminator i-f transformer out of alignment. When changing from magnetic tuning to standard tuning, receiver should operate at its maximum efficiency, that is, there should be no noted change when the magnetic tuning is put in the circuit or taken out of the circuit. If distortion or de-tuning of the receiver is noticed, then it is necessary to refer to the Philco service notes to properly align the discriminator transformer
Resonating vibrations on high-freq. notes	1)	loose voice-coil windings on the cone. Disassemble the speaker and apply voice-coil dope on the loose windings
Intermittent hum	1)	try changing the 6N7G tube

PHILCO 37-10, 37-11—(Code 121)

Inoperative	1)	if 6K5 tube is faulty, substitute a 6Q7G in its place (the diode section of the 6Q7G will not be used)
	2)	see *Note* (*F*) and *Note* (*H*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	3)	check for "shorted" condensers *Nos. 68, 78, 51, 35,* and *9.*
	4)	check for "open" oscillator transformer *No. 28*
	5)	if rectifier tube overheats, check for "shorted" section in condenser *No. 84*

(Cont'd)

PHILCO 37-10, 37-11—(Code 121)—*(Cont'd)*

No magnetic tuning action	1)	check for open coil in oscillator control circuit. This is broadcast coil No. 28. (Part *No. 32-2336*)
	2)	check for "shorted" automatic magnetic tuning switch *No. 36*
Weak reception	1)	if padder cannot be "peaked," check for "open" resonance circuit in i-f transformer *No. 54*
	2)	see *Note* (*F*) and *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Distortion at resonance peak of station	1)	rebalance No. 2 i-f stage
Distortion at low volume	1)	check for "shorted condenser *No. 73*
Audio interference	1)	remove the *green-and-white wire* of audio switch No. 37 from the volume control center lug and connect to the high side of the control
Whistling or squealing, Motorboating sound	1)	check for "open" condensers *No. 5* and *No. 8*
	2)	check 32,000-ohm resistor under oscillator coil section for increase in value. Remove r-f unit and oscillator to reach it. Replace
Hum	1)	check for "open" section in condenser *No. 84*
Dial troubles	1)	see *Note* (*K*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
To improve operation of discriminator circuit in Run #1 and Run #2 receivers	1)	change transformer *No. 48* wiring to 6H6G tube as follows: interchange P1 and K2, interchange P2 and K2, interchange wires of resistors *No. 65* and *No. 66* on the terminal panel which is attached to condenser *No. 63*
Improved performance in Run #1, #2 and #3 receivers	1)	change 6A8G tube to self-bias by connecting a 100-ohm resistor in series with 6A8G tube cathode, and a 0.01-mfd. condenser to by-pass this resistor

PHILCO 37-10, 37-11—(Code 125)

See also Case Histories listed for Philco 37-10, 37-11—(Code 121) receivers

Inoperative	1)	check for "shorted" condenser *No. 80*
	2)	check for "open circuit" in oscillator transformers *No. 11* and *No. 28*
Weak reception	1)	check for "open" primary winding in r-f transformer *No. 33*
Improving reception of Run #1 and Run #2 receivers	1)	for Philco 37-10 receiver, bleeder resistor change to correct voltages of screens and oscillator: replace 10,000-ohm resistor *No. 80* with a 7,500-ohm 3-watt unit, replace 15,000-ohm resistor *No. 83* with a 9,000-ohm 2-watt unit, replace 51,000-ohm resistor *No. 86* with a 32,000-ohm ½-watt unit
	2)	for Philco 37-11 receiver: replace 10,000-ohm resistor *No. 80* with a 7,500-ohm 3-watt unit, replace 15,000-ohm resistor *No. 83* with a 9,000-ohm 2-watt unit, replace 51,000-ohm resistor *No. 86* with a 32,000-ohm 1-watt unit
Improving bass compensation	1)	replace 0.015-mfd. bakelite-encased condenser *No. 41* with a 0.05-mfd. unit

PHILCO 37-33 Battery Receiver

Inoperative	1)	check for "shorted" condensers *Nos. 11, 23, 34, 35*
	2)	if oscillator control grid has a *positive* voltage, check for "shorted" condenser *No. 9*
Inoperative over part of band	1)	check for "open" winding in oscillator transformer *No. 6*
Intermittent reception (all bands)	1)	check for "open" condenser *No. 21*
	2)	check for "open" condenser *No. 22*
Intermittent reception on broadcast band	1)	check for intermittent "open" in oscillator transformer *No. 6*
Intermittent weak reception	1)	check for "open" condenser *No. 33*
Insufficient volume	1)	change audio circuit from phase inversion to transformer type class B, using a 1H4G phase inverter tube as a driver. A Jefferson *No. 467-404* transformer may be used. Change the grid condenser that runs from the plate of the 1H6G to the grid of the 1E7G to the grid of the 1H4G. Disconnect the condenser, also the grid and plate resistors which run from the plate of the 1H4G tube to the other 1E7G grid. Connect the transformer in ordinary way from the 1H4G to the 1E7G, using a 3-volt C-bias on the grid. If the 1E7G is changed to a 1J6G (no change in wiring is necessary) better tone and a reduction of plate current will result
Distortion at low volume	1)	check for "shorted" condensers *No. 28* and *No. 33*
Distortion at high volume, Weak, "tinny" signal	1)	check for "shorted" condenser *No. 23*
Whistling or squealing	1)	check for "open" condenser *No. 11*
	2)	check for low "B" and "C" battery voltages
Short battery life	1)	remove 1,500-ohm resistor across C-battery. Replace with a 6,000-ohm unit. The low value shortens battery life

PHILCO 37-34 Battery Receiver

Inoperative	1)	if pilot light does not light up, check pilot lamp
	2)	check for "grounded" arm in volume control *No. 23*
	3)	check for inoperative vibrator unit
	4)	if choke *No. 42* overheats, check condenser *No. 40* for a "shorted" section
	5)	check for "shorted" condensers *Nos. 16, 35* and *37*
	6)	if vibrator armature is burned, check for "shorted" condensers *No. 43* and *No. 47*
	7)	if there is *positive* voltage on the oscillator control grid, check for "shorted" condenser *No. 13*
	8)	check condenser *No. 40* for a "shorted" section
No signal, or intermittent signal over portion or all of broadcast band	1)	check for "open" in oscillator transformer *No. 11*
	2)	check for "open" in condenser *No. 29*

(Cont'd)

PHILCO 37-34 Battery Receiver—*(Cont'd)*

Distortion at high volume, Weak, "tinny" signals	1)	check for "shorted" condenser *No. 33*
Distortion at low volume	1)	check for "shorted" condenser *No. 29*
Whistling or squealing	1)	check for "open" section in condenser *No. 40*
Hum	1)	check for "open" section in condenser *No. 40*

PHILCO 37-38 Battery Receiver

Inoperative	1)	check for "grounded" arm in volume control *No. 24*
	2)	check for "shorted" condensers *Nos. 30, 36* and *37*
	3)	check for "shorted" compensating condenser *No. 14*
	4)	check for "shorted" section in condenser *No. 18*
	5)	if oscillator control grid has *positive* voltage, check for "shorted" condenser *No. 9*
	6)	check for "open" primary in input transformer *No. 35* and output transformer *No. 38*
Intermittent reception, No signal over portion or all of broadcast band	1)	check for "open" oscillator transformer *No. 13*
	2)	check for "open" in audio input transformer
Weak reception over center of broadcast band	1)	change 32,000-ohm resistor *No. 80* to a 51,000-ohm unit, removing it from the range switch assembly and connecting it from the oscillator grid of the 1C7G tube to ground
Weak reception accompanied by buzzing	1)	check electrolytic condenser block for "open" sections. Replace entire block
Weak reception accompanied by high-pitched howl	1)	check for "leaky" or otherwise faulty audio coupling condenser
Weak reception and excessive image interference	1)	replace faulty antenna coil
Whistling or squealing	1)	connect a 0.05-mfd. condenser (Part *No. 30-4020*) from the screens of the 1C7G det.-osc. and 1D5G i-f tubes to ground
	2)	check for "open" condenser *No. 18*
	3)	check for low "B" and "C" battery voltages
Distortion at high volume, Weak, "tinny" signal	1)	check for insulation breakdown in primary windings of input transformer *No. 35* and output transformer *No. 38*
	2)	check for "shorted" condenser *No. 33*
Distortion at low volume	1)	check for "shorted" condenser *No. 33*
Improving sensitivity	1)	sensitivity of early production receivers may be improved in the center of the broadcast band by replacing 32,000-ohm resistor (*8*) with a 51,000-ohm unit (Part *No. 33-351339*). The resistor is removed from the range switch assembly and is connected directly to the oscillator grid of the 1C7G tube and ground

(Cont'd over)

PHILCO 37-38 Battery Receiver—*(Cont'd)*

Improving operation of receiver	1)	on receivers produced previous to Run 4, operation may be improved by reversing the filament wiring of the 1D5G i-f tube. Referring to the Philco schematic diagram, "F" of the 1D5G socket becomes "F"-minus and is grounded to the lug adjacent to the socket
Short battery life	1)	remove the 900-ohm resistor across the "C" battery. Replace with 6,000-ohm value. The low value shortens batt. life

PHILCO 37-60

Inoperative	1)	"shorted" condenser *No. 16*
	2)	"grounded" arm in volume control *No. 22*
	3)	"open" primary in i-f transformer *No. 15*
	4)	"open" primary in output transformer *No. 38*
	5)	"shorted" compensating condenser *No. 8*
Inoperative over a portion or all of broadcast band, Intermittent reception	1)	"open" oscillator transformer *No. 9*
Distortion at resonance peak of station	1)	rebalance No. 2 i-f stage
	2)	"shorted" secondary in i-f transformer *No. 27*
Distortion at low volume	1)	"shorted" condenser *No. 35*
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 35*
Improvements made in later productions of receivers	1)	beginning with Run 2, condenser (*11*) was changed from a 1,000-mmfd. tubular unit to a 250-mmfd. mica unit (Part *No. 30-1032*). Resistor (*12*) was changed from Part *No. 33-351339* to Part *No. 33-332339* to prevent relaxation oscillation
	2)	beginning with Run 6, the suppressor grid of the 6K7G tube is removed from ground and connected to the 2.5-volt negative tap of bias resistor (*43*)
	3)	beginning with Run 9, the i-f transformers are changed as follows: 1st i-f transformer (15) (old Part *No. 32-2100*) has been changed to new transformer (Part *No. 32-2274*) 2nd i-f transformer (27) (old Part *No. 32-2102*) has been changed to new transformer (Part *No. 32-2276*). The new first i-f transformer has a stabilized winding which is placed in series with the suppressor grid of the 6K7G i-f tube. The short or *yellow*-colored lead is connected to the ground lug, and the long lead to the suppressor grid

PHILCO 37-61

See also Case Histories listed for Philco 37-60 receiver

Improvements made in later productions of receivers	1)	beginning with Run 2, 100-mmfd. condenser (*11*) is changed to 250-mmfd. condenser (Part *No. 30-1032*). Resistor (*12*) is changed from Part *No. 33-351339* to Part *No. 33-332339*
	2)	beginning with Run 6, the suppressor grid of the 6K7G is removed from ground

(Cont'd)

PHILCO 37-61—*(Cont'd)*

Improvements made in later productions of receivers —*(Cont'd)*		and connected to the negative 2.5-volt tap of the bias resistor (43)
	3)	the 1st i-f transformer (15) has been changed from Part *No. 32-2100* to new Part *No. 32-2274*. The new transformer has a stabilizing winding which is placed in series with the suppressor grid of the 6K7G i-f tube. The short or *yellow-colored* lead is connected to the ground lug; long lead goes to suppressor grid. The 2nd i-f transformer (27) has been changed from Part *32-2102* to *32-2276*

PHILCO 37-62

Inoperative	1)	if rectifier tube overheats, check for "shorted" section in condenser *No. 32*
	2)	check for "shorted" section in condensers *No. 29, 23* and *15*
	3)	"open" oscillator transformer *No. 8*
	4)	"open" primary in output transformer *No. 37*
	5)	"open" field coil *No. 36*
Intermittent reception	1)	"open" condenser *No. 16* and *22*
Weak reception	1)	check for broken wires on r-f transformer *No. 2*
Weak reception sometimes distorted at high volume	1)	"open" or "leaky" section in condenser *No. 32*
Distortion at resonance peak of station	1)	rebalance No. 2 i-f stage
	2)	"shorted" secondary in i-f transformer *No. 17*
Distortion at low volume	1)	"shorted" condenser *No. 22*
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 29*
Hum	1)	"open" section in condenser *No. 32*
Whistling or squealing	1)	change 25,000-ohm screen resistor to a 32,000-ohm unit

PHILCO 37-84 (Code 122)

Inoperative	1)	"open" primary in output transformer *No. 25*
	2)	"open" field coil *No. 27*
	3)	"shorted" condensers *No. 20* and *24*
	4)	if rectifier tube overheats, check for "shorted" section in condenser *No. 29*
Intermittent reception	1)	intermittent "open" in i-f transformer *No. 14*
Inoperative	2)	intermittent "open" in condenser *No. 20*
Distortion at high or low volume	1)	"shorted" condenser *No. 20*
Whistling or squealing	1)	"open" section in condenser *No. 29*
	2)	"open" condensers *No. 9* and *28*
Reduce hum	1)	change 4-8 mfd. electrolytic condenser to 8-8-mfd. unit (Part *No. 30-2079*). (Factory change made after Run 4)
	2)	"open" condenser *No. 29*

PHILCO 37-89

Inoperative	1)	"shorted" compensating condenser *No. 12*
	2)	"shorted" condensers *Nos. 17, 29* or *38*
	3)	"open" field coil *No. 46*
	4)	"grounded" arm in volume control *No. 26*
	5)	"open" primary in *No. 42* output transformer

(Cont'd)

PHILCO 37-89—*(Cont'd)*

Inoperative over portion or all of broadcast band, Intermittent reception	1)	check for "open" oscillator transformer *No. 13*
Weak reception	1)	"open" r-f choke *No. 11*
Distortion at resonance peak of station	1) 2)	rebalance No. 2 i-f stage "shorted" secondary of i-f transformer *No. 20*
Distortion at low volume	1)	"shorted" condenser *No. 41*
Distortion at high volume, Weak "tinny" signal	1)	"shorted" condenser *No. 38* or *No. 41*
Hum accompanied by weak reception	1)	"shorted" condenser *No. 47*
To improve oscillator action	1)	change 32,000-ohm resistor *No. 15* to one of 70,000 ohms
To improve performance in receivers previous to Run #5	1)	replace first i-f transformer *No. 19* with new type unit (Part *No. 32-2274*) which has a stabilizing winding placed in series with the suppressor grid of the 6K7G i-f tube. The short or *yellow*-colored lead is connected to the ground lug, and the long lead to the suppressor grid. Replace 2nd i-f transformer *No. 20* with new type (Part *No. 32-2276*). Replace 700-ohm resistor *No. 24* with 400-ohm unit (Part *No. 33-1211*)

PHILCO 37-93

Inoperative	1) 2) 3) 4) 5)	"shorted" section in condenser *No. 6* "shorted" section in condensers *No. 5* and *No. 19* "open" oscillation transformer *No. 11* "open" primary in output transformer *No. 28* if rectifier tube overheats, check for "shorted" section in condenser *No. 6*
Intermittent reception	1)	"open" condenser *No. 22*
Low volume, No AVC	1) 2)	check coupling wire from terminal No. 1 of the antenna coil (Part *No. 32-2329*) to terminal No. 4. This coupling wire often "shorts" intermittently or permanently across the primary and secondary of the antenna coil terminals check antenna transformer for "open"
Weak reception accompanied by distortion at high volume	1)	"open" or "leaky" condenser *No. 6*
Distortion at resonance peak of station	1) 2)	rebalance No. 2 i-f stage "shorted' secondary in i-f transformer *No. 14*
Distortion at low volume	1)	"shorted" condenser *No. 22*
Whistling or squealing	1) 2)	"open" condenser *No. 5* "open" section in condenser *No. 6*
Hum	1)	"open" section in condenser *No. 6*

PHILCO 37-116 (Codes 121, 122)

Inoperative	1) 2) 3) 4) 5) 6) 7) 8) 9) 10) 11)	see *Note* (*F*) and *Note* (*H*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories if resistor *No. 118* overheats, check condenser *No. 62* for "shorted" section, and condenser *No. 76* for "short" if resistor *No. 15* overheats, check for "shorted" condenser *No. 13* if resistor *No. 124* section overheats, check for "shorted" condensers *No. 26* and *63* if resistor *No. 69* overheats, check for "shorted" condenser *No. 66* if resistor *No. 70* overheats, check for "shorted" condenser *No. 79* if resistors *No. 46* and *48* overheat, check for "shorted" condenser *No. 47* if resistor *No. 33* burns, check for "shorted" condenser *No. 36* if rectifier tube overheats, check for "shorted" section in condenser *No. 123* "shorted" condenser *No. 62* (sometimes indicated by "frying" noise) if resistor *No. 124* overheats, check for "shorted" section in condensers *No. 62* and *No. 44*
Inoperative over portion of broadcast band	1)	condenser *No. 53* changed value. Replace
Inoperative on police band	1)	"open" primary lead on the first-detector coil, connected from the coil to a lug on the band switch directly beneath it. It can be repaired with a bent soldering iron tip and a piece of bare wire
Weak reception	1) 2)	see *Note* (*F*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories see *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories (may be an intermittent condition)
Weak "tinny" signal, Distortion	1)	"shorted" condenser *No. 96* or *No. 98*
Poor AVC action (stations are "pushed away" instead of being "pulled in")	1)	the position of the cathode leads from the discriminator transformer should be checked to determine whether they are connected in the reverse positions. It is possible when replacing the discriminator transformer to reverse these leads to the diode plates of the 6H6G tube in the discriminator circuit. The new transformer when installed should be mounted so that the *bare wire* leads face the rear of the chassis. They will in turn extend in perfect order, the bottom one to the bottom contact and the top to the top contact on the tube socket
Whistling (on broadcast band)	1) 2)	dress the three leads behind the expander and volume control up away from the chassis. They are *green, yellow* and *green-and-white*, and usually taped together "open" condenser *No. 62*
Whistling or squealing at "expanded" position of sensitivity control	1)	dress *white* plate lead of 6L7G tube so it lays across 6L7G socket and thence into oscillator section close to the base and from here through the second aperture from the front of r-f unit into i-f unit
Hum	1)	"open" section in condenser *No. 123*

(Cont'd over)

PHILCO 37-116 (Codes 121, 122)—*(Cont'd)*

Distortion on strong signal	1)	if avc and afc works improperly (or not at all), check tertiary winding on third i-f transformer
Frequency drift (retuning receiver brings station back)	1)	tighten set-screws on tuning condenser drive assembly. Replace tuning condenser drive coupling buckle
Oscillator tracks or drifts "high"	1)	if 1500 kc signal appears at about 1600 kc on dial when oscillator padder is completely open, check for "open" condensers *No. 31* and *No. 32*
Magnetic tuning inoperative	1)	"shorted" automatic magnetic tuning switch *No. 93*
	2)	if rest of set checks O.K., check pentagrid mixer-amplifier tube type number. It should be a 6L7G—not a 6N7G or a 6J7G
Magnetic tuning drifts	1)	replace magnetic tuning transformer *No. 81* with improved type
Dial troubles	1)	see Note (K) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

PHILCO 37-116X

Fuse blows	1)	if 5V4G rectifier tube arcs across elements, check for broken filament support spring in 6B4G output tubes
Inoperative, (between 530 kc and 900 kc) Failure to "track" on middle of broadcast band	1)	changed capacity value of 250-mfd. condenser *No. 33*). Replace with a new condenser
Frequency drift (retuning receiver brings fading station back in)	1)	remove compensator assembly and remove 0.05-mfd. tubular condenser *C-28* located under r-f compensator condenser. Replace with a 450-volt unit. Replace compensator assembly. Realign receiver
Distortion	1)	check bias resistor *No. 96*. This is a 3-section flat, wire-wound resistor (Part *No. 33-3212*) having a resistance of 17.6, 90.4 and 257 ohms respectively. Some short intermittently through the insulator to ground. Quickest remedy is to substitute a new resistor unit

PHILCO 37-600

Inoperative	1)	"shorted" section in condenser *No. 38*
	2)	"shorted" condenser *No. 10* or *No. 11*
	3)	"grounded" padder condenser *No. 6*
	4)	"open" field coil *No. 34*
Weak reception	1)	if padder *No. 23* is ineffective, check for "open" or 'shorted" i-f transformer *No. 19*
	2)	"grounded" r-f padder *No. 5*
Weak reception at low-frequency end of band	1)	in receivers made previous to Run 3, change 200-ohm resistor (7) (Part *No. 7217*) to a 300-ohm unit (Part *No. 33-3010*)
	2)	remove the suppressor wire of the 6J7G i-f tube from the cathode terminal of the socket and connect it to the same lug of the sensitivity control (23) to which the secondary lead of i-f transformer (19) is connected
Distortion	1)	"shorted" condenser *No. 27*
Whistling or squealing	1)	"open" condenser *No. 10*, *No. 35*, or *No. 37*
Hum	1)	"open" condenser *No. 38*

PHILCO 37-602

Inoperative	1)	"open" field coil *No. 51*
	2)	"grounded" resistor *No. 36*
	3)	"shorted" section in condenser *No. 12* or *No. 35*
Intermittent reception, Inoperative	1)	"grounded" or "open" circuit in oscillator transformer *No. 5*
	2)	"open" section in condenser *No. 12*
Weak reception (low plate voltages)	1)	"open" condenser *No. 13*
Weak reception at low-frequency end of band	1)	in receivers made previous to Run 5, change 200-ohm resistor (19) (Part *No. 7217*) to a 300-ohm unit (Part *No. 33-3010*)
	2)	change 0.03-mfd. condenser (48) to a 0.02-mfd. unit (Part *No. 30-4113*)
Weak reception above 1000 kc	1)	check for "faulty" contacts at oscillator coil lugs. Resolder all these connections
Whistling or squealing	1)	"open" condenser *No. 13*
Motorboating, Whistling	1)	"open" condenser *No. 12*
Distortion	1)	"grounded" condenser *No. 13*
Distortion at low volume	1)	"shorted" condenser *No. 45*
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" section in condenser *No. 12*
Speaker rattle	1)	cement two rubber grommets through which voice coil leads pass to speaker frame (use coil "dope")
To increase life of electrolytic filter condensers	1)	disconnect filament voltage dropping resistor located under chassis and install a line-cord type resistor in its place so the heat will be developed outside the chassis. Leave original resistor in place as part of it is used to provide the pilot light voltage. Connect the pilot light resistor between the 6A8G and 6Q7G filaments, and connect the line resistor to the 25Z6G filament

PHILCO 37-604

Inoperative	1)	"shorted" low-frequency padder *No. 6*
	2)	"open" oscillator transformer *No. 7*
	3)	"shorted" condenser *No. 23* or *No. 49*
	4)	"shorted" section in condenser *No. 42*
	5)	"open" field coil *No. 45*
Weak reception (plate voltages all low)	1)	"open" condenser *No. 42*
Whistling, Distortion	)	"open" 0.1-mfd. by-pass condenser connected across 300-ohm cathode resistor of 6K7G tube
	2)	"open" condenser *No. 23* or *No. 21*
Motorboating sound, Whistling	1)	"open" condenser *No. 42*
Distortion (weak, "tinny" signals)	1)	"shorted" condenser *No. 23* or *No. 38*
Distortion at low volume	1)	"shorted" condenser *No. 38*
Hum	1)	"open" section in condenser *No. 42*

PHILCO 37-610 (Codes 121 and 122)

Inoperative	1)	see *Note* (*F*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"shorted" condenser *No. 22A*
	3)	"open" plate winding in s.w. oscillator transformer *No. 18*
	4)	"grounded" arm in volume control *No. 42*
	5)	"open" primary in output transformer *No. 48*
Inoperative, Intermittent (on broadcast band only)	1)	"open" oscillator transformer *No. 12*
Inoperative on short-waves	1)	small mica condenser (Part *No. 20*) soldered to tuning condenser has worked loose. Resolder and bend to clear plates of variable condenser
Inoperative on third band (7.35 to 22 mc.)	1)	check for "shorted" fixed condenser in the oscillator section for range 3. This is 250-mmfd. condenser No. 7 (Part *No. 30-1032*)
Weak reception	1)	high resistance develops in grid circuit of first i-f coil. Replace the coil and resolder the grid cap connection
	2)	see *Note* (*F*) and *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Noisy, intermittent reception	1)	check for loose oscillator or r-f stage trimmers. If trimmer must stay wide open, bend its plates back so they are rigid and won't shift
Whistling or squealing	1)	"open" condenser *No. 8*
Distortion at resonance peak of station	1)	realign No. 2 i-f stage
	2)	"shorted" secondary in i-f transformer *No. 27*
Distortion, Weak, "tinny" signal	1)	"shorted" condenser *No. 45*
Hum, Weak, Distortion	1)	replace the 6K7G tube
Cracking-up at low volume	1)	connect a 110-mmfd. condenser (Part No. 30-1031) from the arm of the volume control to ground
Frequency drift (retuning receiver brings fading station back)	1)	see *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Dial troubles	1)	see *Note* (*I*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Improving operation of receiver	1)	on receivers made previous to Run 3, remove connection from suppressor grid of 6K7G tube to ground and connect the suppressor grid to the 2.5-volt negative tap of the bias resistor (54)
	2)	changing 0.008-mfd. 400-volt condenser *No. 51* to a 0.008-mfd. 1,000-volt unit will assure freedom from breakdown of this part

PHILCO 37-610 (Codes 125 and 126)

(This model differs from Philco 37-610 Codes 121 and 122 receivers only in the r-f assembly)

Inoperative (on all bands)	1)	see *Note* (*F*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"shorted" condenser *No. 12*

(Cont'd)

PHILCO 37-610 (Codes 125 and 126)—*(Cont'd)*

Inoperative (on all bands) —*(Cont'd)*	3)	"open" plate winding in s.w. transformer *No. 6*
	4)	"open" primary in output transformer *No. 53*
Intermittent reception, Inoperative (on broadcast band only)	1)	"open" oscillator transformer *No. 15*
Weak reception	1)	see *Notes* (*F*) and (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Whistling or squealing	1)	"open" condenser *No. 5*
Distortion at resonance peak of station	1)	realign No. 2 i-f stage
	2)	"shorted" secondary in i-f transformer *No. 26*
Distortion, Weak, "tinny" signal	1)	"shorted" condenser *No. 42*
Frequency drift (retuning receiver brings fading station back)	1)	see *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Dial troubles	1)	see *Note* (*I*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

PHILCO 37-611

Inoperative	1)	see *Note* (*F*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" plate winding in oscillator transformer *No. 13*
	3)	"shorted" condensers *No. 39* and *No. 59*
	4)	"grounded" arm in volume control *No. 30*
	5)	"shorted" section in condenser *No. 44*
Intermittent reception, Inoperative	1)	"open" condenser *No. 42*
	2)	if trouble is on *broadcast band* only, check for "open" oscillator transformer *No. 8*
	3)	if trouble is on *band #3*, check for "shorted" condenser *No. 16*
Weak reception	1)	see *Note* (*F*) and *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Whistling or squealing	1)	"open" section in condenser *No. 6*
Whistling or squealing below 550 kc	1)	connect a 1,000-ohm resistor (Part *No. 33-210339*) in series with *red* primary lead of 2nd i-f transformer *No. 23;* also connect a 0.05-mfd. condenser (Part *No. 30-4123*) from the *red* wire contact to ground
Motorboating sound	1)	"open" section in condenser *No. 18*
Distortion at resonance peak of station	1)	realign No. 2 i-f stage
	2)	"shorted" secondary in i-f transformer *No. 23*
Distortion at low volume	1)	"shorted" condenser *No. 42*
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 39*

(Cont'd over)

PHILCO 37-611—*(Cont'd)*

Hum	1)	"open" condenser *No. 44*
Frequency drift (retuning receiver brings fading station back)	1)	see *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Dial troubles	1)	see *Note* (*I*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

PHILCO 37-620 (Codes 121 and 122)

Inoperative	1)	see *Note* (*F*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"shorted" condensers *Nos. 12, 14* or *20*
	3)	"grounded" arm in volume control *No. 49*
	4)	"open" plate winding in oscillator transformer *No. 26*
	5)	"open" primary in output transformer *No. 52*
No reception at low-frequency end of short-wave band (7.35 to 22 mc.)	1)	check mica condenser in oscillator stage, range 3, for a "short". This is 250-mfd. condenser No. 27 (Part No. 30-1032)
	2)	"shorted" condenser *No. 28*
Inoperative, Intermittent reception (in either case, volume level falls sharply accompanied by resonance hiss)	1)	by connecting the aerial to the control-grid of the 6A8 or 6L7 (whichever tube may be employed as the 1st detector), or placing a finger upon the control-grid, volume level becomes nearly normal and the resonance hiss clears up to a great extent. This procedure indicates the trouble to lie within the r-f stage. However, a volt-ohmmeter or analyzer will not point to the difficulty, which is a snapped lead, from the stator lug of the r-f section of the gang condenser to a lug on the wave-band switch, at the wave-band switch lug. It is quite unnecessary to remove the assembly to resolder this lead if the soldering tip is only ⅝-in. in dia. and at least 2 ins. or slightly less in length. The complaint of hum, which is still present with the rectifier tube removed from its socket may often be remedied by tightening the assembly and mounting bolts and nuts of the power transformer; otherwise, replacement of the transformer becomes necessary
Inoperative, or Intermittent reception (on broadcast band only)	1)	"open" oscillator transformer *No. 22*
Weak reception	1)	see *Notes* (*F*) and (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Distortion at resonance peak of station	1)	realign No. 2 i-f stage
	2)	"shorted" secondary in i-f transformer *No. 36*
Distortion, Weak, "tinny" signal	1)	"shorted" condenser *No. 48*
	2)	install 110-mmfd. condenser from center arm of volume control to ground
Microphonics	1)	in receivers made previous to Run 3, this trouble may be cured by installing the impaired type i-f transformers. The new 1st i-f transformer is Part *No. 32-2100-X;* the new 2nd i-f transformer is Part *No. 32-2102-X*

(Cont'd)

PHILCO 37-620 (Codes 121 and 122)—*(Cont'd)*

Whistling or squealing	1)	"open" condensers *No. 5* and *No. 15*
	2)	in early receivers change 400-ohm resistor to a 700-ohm unit (Part No. *33-1220*). Also change 0.05-mfd. condenser (35) to a 0.25-mfd. unit (Part *No. 30-4446*)
Crack-up at low volume	1)	connect a 110-mmfd. condenser (Part *No. 30-1031*) from the arm of the volume control to ground
Frequency drift (retuning receiver brings fading station back)	1)	see *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Dial troubles	1)	see *Note* (*I*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

PHILCO 37-620 (Codes 125 and 126)

(This model differs from the Philco 37-620 Codes 121 and 122 receivers only in the r-f assembly)

Inoperative	1)	see *Note* (*F*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"shorted" condensers *No. 17* and *No. 26*
	3)	"open" plate winding in oscillator transformer *No. 11*
	4)	"open" primary winding in output transformer *No. 63*
Inoperative on short-wave band *No. 3*	1)	"shorted" condenser *No. 14*
Intermittent reception, Inoperative (on broadcast band only)	1)	"open" oscillator transformer *No. 23*
Weak reception	1)	see *Note* (*F*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	see *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Whistling or squealing	1)	"open" condenser *No. 6* or *No. 10*
Distortion at resonance peak of station	1)	realign No. 2 i-f stage
	2)	"shorted" secondary in i-f transformer *No. 36*
Distortion, Weak, "tinny" signal	1)	"shorted" condenser *No. 50*
Frequency drift (retuning receiver brings fading station back)	1)	see *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Dial troubles	1)	see *Note* (*I*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

PHILCO 37-623

Inoperative	1)	see *Note* (*F*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"shorted" condensers *Nos. 11, 13, 51, 52, 32, 8,* or *17*
	3)	"grounded" arm in volume control *No. 40*

(Cont'd)

PHILCO 37-623—*(Cont'd)*

Inoperative —*(Cont'd)*	4)	"open" plate winding in oscillator transformer *No. 28*
	5)	"open" primary in output transformer *No. 53* (usually indicated by "frying" noise)
	6)	"open" primary in input transformer
	7)	"leaky" insulation on oscillator section of range switch. Replace this section of switch
Inoperative on short-wave band *No. 3*	1)	"shorted" condenser *No. 26*
	2)	if this action is intermittent and can be traced to intermittent oscillator operation, cut off the screen grid voltage supply lead from terminal beneath chassis, and connect a 15,000-ohm resistor between this terminal and 135-volt supply terminal
Inoperative, Intermittent reception (on broadcast band only)	1)	"open" oscillator transformer *No. 18*
Weak reception	1)	see *Note* (*F*) and *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Distortion at resonance peak of station	1)	realign second i-f stage
	2)	"shorted" secondary in i-f transformer *No. 30*
Distortion at low volume	1)	"shorted" condenser *No. 33*
Distortion, Weak, "tinny" signal	1)	"shorted" condensers *No. 32* and *No. 33*
	2)	"open" primary in input transformer *No. 50*
Distortion ("mushy" tone)	1)	"open" output transf. primary. Replace
Whistling or squealing	1)	"open" condenser *No. 59*
	2)	low "B" or "C" battery voltages
Frequency drift (retuning receiver brings fading station back)	1)	see *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Dial troubles	1)	see *Note* (*I*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Change for improved performance in receivers made previous to Run #4	1)	replace 1st i-f transformer *No. 28* with new type unit (Part *No. 32-2296*). Replace 2nd i-f transformer *No. 30* with new type unit (Part *No. 32-2298*) having a tertiary winding which should be connected in series with the screen of the 1D5G tube
Change for improved performance in receivers made previous to Run #3	1)	receivers made previous to Run 3 may be improved by reversing the filament wiring of the 1D5G i-f tube. The ground terminal adjacent to the socket should be connected to the terminal marked "F" which is to the left of the centering pin. When the connections are being reversed, be sure to transfer *all* connections from one contact to the other

PHILCO 37-624

Inoperative	1)	see *Note* (*F*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" plate winding in oscillator transformer *No. 30*

(Cont'd)

PHILCO 37-624—*(Cont'd)*

Inoperative —*(Cont'd)*	3)	if choke *No. 73* overheats, check for "shorted" section in condenser *No. 64*
	4)	if resistor *No. 37* overheats, check for "shorted" condenser *No. 13*
	5)	"shorted" condenser *No. 38* or *No. 64*
	6)	"shorted" condenser *No. 15, 17* or *21*
	7)	if resistor *No. 68* overheats, check for "shorted" section in condenser *No. 34*
	8)	check for "grounded" arm in volume control *No. 49*
	9)	vibrator inoperative
	10)	if vibrator armature is burned, check for "shorted" condensers *No. 75* and *No. 77*
	11)	"open" primary in input transformer *No. 61* or output transformer *No. 66*
	12)	"open" condenser *No. 54*
Inoperative, Intermittent reception (on broadcast band only)	1)	"open" oscillator transformer *No. 23*
Inoperative, Intermittent reception (on short-wave *No. 3* band only)	1)	"shorted" condenser *No. 32*
Weak reception	1)	see *Note* (*F*) and *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Distortion at resonance peak of station	1)	realign No. 2 i-f stage
	2)	"shorted" secondary in i-f transformer *No. 41*
Distortion at low volume	1)	"shorted" condenser *No. 54*
Distortion, Weak, "tinny" signal	1)	faulty primary in input transformer *No. 61* or output transformer *No. 66*
Whistling or squealing	1)	"open" section in condensers *Nos. 34, 38*, or *64*
Hum	1)	"open" condenser *No. 64*
Frequency drift (retuning receiver brings fading station back)	1)	see *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Dial troubles	1)	see *Note* (*I*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Improving performance of receiver	1)	replace 1st i-f transformer *No. 40* with new type transformer (Part *No. 32-2296*). Replace 2nd i-f transformer *No. 41* with new type (Part *No. 32-2298*) having a tertiary winding which must be connected in series with the screen circuit of the 1D5G i-f tube

PHILCO 37-630 (Codes 121 and 122)

Inoperative	1)	see *Note* (*F*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"shorted" condenser *No. 20*
	3)	"grounded" arm in volume control *No. 49*
	4)	"open" plate winding in oscillator transformer *No. 26*

(Cont'd over)

PHILCO 37-630 (Codes 121 and 122)—*(Cont'd)*

Inoperative —*(Cont'd)*	5)	if tuning meter shadow is unusually wide, check for "shorted" condensers *No. 12* and *No. 14*
	6)	if tuning meter shadow is unusually narrow, check for "open" tuning meter *No. 33*
No reception at low-frequency end of short-wave band (7.35 to 22 mc)	1)	check mica condenser in oscillator stage, range 3, for a "short." This is 250-mmfd. condenser No. 12 (Part No. 30-1032)
	2)	"shorted" condenser *No. 28*
Inoperative, Intermittent reception (in either case, volume level falls sharply accompanied by resonance hiss)	1)	see Case History for this same trouble symptom listed for Philco 37-620 receiver
Inoperative, Intermittent reception, (on broadcast band only)	1)	"open" oscillator transformer *No. 22*
	2)	check oscillator transformer connections. A high-resistance joint on the connection at the trimmers or padding condensers for this band will have this effect
Weak reception	1)	see *Note* (*F*) and *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Whistling or squealing	1)	"open" condenser *No. 5* or *No. 15*
	2)	tube shields corroded at base
	3)	change 400-ohm resistor (34) to a 700-ohm unit (Part *No. 33-1220*). Change 0.05-mfd. condenser (34) to a 0.25-mfd. unit Part *No. 30-4446*)
Distortion at resonance peak of station	1)	realign No. 2 i-f stage
	2)	"shorted" secondary in *No. 36* i-f transformer
Distortion, Weak, "tinny" signal	1)	"shorted" condenser *No. 48*
Noisy reception	1)	check rear bearing of tuning gang. Oil bearing
	2)	loose speaker voice coil leads
Frequency drifts (retuning receiver brings fading station back)	1)	see *Note* (*G*) listed for "Philco Receiver General Servicing Data" at beginning of Philco case histories
Microphonics	1)	in receivers made prior to Run 3, install new type 1st i-f transformer (Part *No. 32-2100-X*) and new type 2nd i-f transformer (Part *No. 32-2102-X*)
Dial troubles	1)	see *Note* (*I*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

PHILCO 37-630 (Codes 125 and 126)

Same Case Histories as those listed for Philco 37-320 (Codes 125 and 126 receiver)

PHILCO 37-640 (Codes 121 and 125)

(Code 125 receiver differs from Code 121 receiver in the r-f unit only)

Inoperative	1)	see *Note* (*F*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

(Cont'd)

PHILCO 37-640 (Codes 121 and 125)—*(Cont'd)*

Inoperative —*(Cont'd)*	2)	"open" primary in output transformer *No. 53*
	3)	"open" field coil *No. 67*
	4)	"grounded" arm in volume control *No. 42*
	5)	"open" plate winding in oscillator transformer *No. 26*
	6)	"shorted" condensers *Nos. 52, 60, 61* and *20*
	7)	"shorted" condenser *No. 66* (indicated by overheated rectifier tube)
	8)	"shorted" condensers *No. 12* and *No. 14* (indicated by wide tuning meter shadow)
	9)	"open" tuning meter *No. 31* (indicated by narrow tuning meter shadow)
Inoperative (on low end of band *No. 3*)	1)	"shorted" condenser *No. 17*
Inoperative, Intermittent reception (in either case, volume level falls sharply accompanied by resonance hiss)	1)	see Case History for this same trouble symptom listed for Philco 37-620 receiver
Inoperative, Intermittent reception, (on broadcast band)	1)	"open" oscillator transformer *No. 22*
Weak reception	1)	see *Note* (*F*) and *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	replace 0.05-mfd. A.V.C. bypass condenser in the r-f stage
Distortion at resonance peak of station	1)	realign No. 2 i-f stage
	2)	"shorted" secondary in i-f transformer *No. 34*
Distortion, Weak, "tinny" signal	1)	"shorted" condensers *No. 44* and *No. 61*
Whistling or squealing	1)	change 400-ohm resistor (32) to a 700-ohm unit (Part *No. 33-1220*). Also change 0.05-mfd. condenser (30) to 0.25-mfd. unit (Part *No. 30-4446*)
	2)	"open" condenser *No. 5* or *No. 15*
Hum	1)	"open" section in condenser *No. 66*
Frequency drift (retuning receiver brings fading station back)	1)	see *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Dial troubles	1)	see *Note* (*I*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Microphonics	1)	in receivers made prior to Run 3, install new type 1st i-f transformer (Part *No. 32-2100-X*) and new type 2nd i-f transformer (Part *No. 32-2102-X*)

PHILCO 37-641 (Codes 121 and 125)

Inoperative	1)	see *Note* (*F*) and *Note* (*G*) listed under ceiver General Servicing Data" at beginning of Philco case histories
	2)	"shorted" section in condenser *No. 25*

(Cont'd)

PHILCO 37-641 (Codes 121 and 125)—*(Cont'd)*

Inoperative —*(Cont'd)*	3)	if tuning meter shadow is unusually narrow, check for "open" tuning meter *No. 74*
	4)	"grounded" arm in volume control *No. 31*
	5)	"shorted" condensers *No. 34* and *No. 57*
	6)	"open" plate winding in oscillator transformer *No. 13*
	7)	if tuning meter shadow is unusually wide, check for "shorted" condensers *Nos. 9X, 24X* and *28*
Inoperative, Intermittent reception	1)	"open" condensers *No. 68* and *No. 54*
Inoperative, Intermittent reception, (on broadcast band only)	1)	"open" oscillator transformer *No. 22*
Weak reception	1)	see *Note (F)* and *Note (G)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Distortion at resonance peak of station	1)	realign No. 2 i-f stage
	2)	"shorted" secondary in i-f transformer *No. 35*
Distortion at low volume	1)	"shorted" condensers *No. 54* and *No. 68*
Whistling or squealing	1)	"open" condenser *No. 25*
Frequency drift (retuning receiver brings fading station back)	1)	see *Note (G)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Dial troubles	1)	see *Note (I)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Pilot light burns out	1)	shunt a 33-ohm 2-watt resistor across pilot light
Improving reception at 18 mc in Code 121 receivers previous to Run 4-4 and Code 125 receivers previous to Run 1-2	1)	add a 250-mmfd. condenser (Part *No. 30-1032*) from screen of det-osc. to ground. Add a 0.1-mfd. condenser (Part *No. 30-4455*) from B-negative to ground in the i-f unit
Improving performance on broadcast range	1)	change present range switch *No. 76* to new type (Part *No. 42-1314*); connect a 35-mmfd. condenser (Part *No. 30-1044*) across primary of r-f transformer *No. 36*. Wire this condenser from the additional lug on this new range switch to ground

PHILCO 37-643

Inoperative	1)	see *Note (F)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"shorted" primary in output transformer *No. 61* and input transformer *No. 59* (sometimes indicated by "frying" noise)
	3)	"grounded" arm in volume control *No. 42*

(Cont'd)

PHILCO 37-643—*(Cont'd)*

Inoperative —*(Cont'd)*	4)	"shorted" condensers *Nos. 20, 54, 60* and *63*
	5)	"shorted" section in condenser *No. 31*
	6)	"shorted" condensers *Nos. 46X, 17* and *19* (indicated by wide tuning meter shadow)
	7)	"shorted" condenser *No. 48* (indicated by narrow tuning meter shadow)
	8)	"open" tuning meter *No. 47X* (indicated by narrow tuning meter shadow)
Inoperative (on broadcast bands *No. 3* and *No. 4*)	1)	"shorted" condenser *No. 10*
	2)	"open" plate winding in oscillator transformer *No. 27*
Inoperative, Intermittent reception (on broadcast band only)	1)	"open" oscillator transformer *No. 21*
Weak reception	1)	see *Note (F)* and *Note (G)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Distortion at resonance peak	1)	realign No. 2 i-f stage
	2)	"shorted" secondary in i-f transformer *No. 34*
Distortion at low volume	1)	"shorted" condenser *No. 58*
Whistling or squealing	1)	"open" section in condenser *No. 31*
	2)	low "B" and "C" battery voltages
Frequency drift (retuning receiver brings fading station back)	1)	see *Note (G)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Dial troubles	1)	see *Note (I)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

PHILCO 37-650

Inoperative	1)	see *Note (F)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" plate winding in oscillator transformer *No. 18*
	3)	"grounded" arm in volume control *No. 39*
	4)	"shorted" condensers *Nos. 14, 47, 48* and *51*
	5)	"shorted" condensers *No. 8* and *No. 15* (indicated by wide tuning meter shadow)
	6)	"shorted" 0.1-mfd. condenser *No. 25* (indicated by narrow tuning meter shadow)
	7)	"open" tuning meter *No. 27* (indicated by narrow tuning meter shadow)
	8)	"shorted" section in condenser *No. 59* (indicated by overheated rectifier tube)
Inoperative, Intermittent reception	1)	"open" condenser *No. 45*
Inoperative, Intermittent reception (in either case, volume level falls sharply accompanied by resonance hiss)	1)	see Case History for this same trouble symptom listed for Philco 37-620 receiver
	2)	check mica insulating material in oscillator compensating condenser block assembly. This consists of six sections which serve to tune all ranges in this model

(Cont'd over)

PHILCO 37-650—*(Cont'd)*

No reception on broadcast band	1)	check the range switch section (Part *No. 42-1190*) for "shorted" wiring leads to the switch terminals. Due to the location of the range switch in the r-f assembly, the wiring leads often "short" at a point where they cross over each other
	2)	"open" circuit in oscillator transformer *No. 17*
Intermittent fading	1)	check mica condenser (8) Part *No. 30-1076*). A 25 or 30-megohm "short" may develop intermittently, causing a positive voltage of 4 to 5 volts in the AVC circuit
	2)	if condition disappears when the AVC is "shorted" to ground, try replacing the 6K7G in either the r-f or i-f circuit. If the suppressor grid "shorts" to the screen grid of the tube, a positive voltage in the AVC circuit will be noted. Usually a tube having this condition can be easily located by standing the chassis on its end and tapping the glass bulb. This will induce an intermittent or permanent "short" between the elements and show up the trouble
Weak reception	1)	see *Note* (*F*) and *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	replace range switch *No. 68* (r-f section) if damp (indicated by delayed avc action on weak signal)
Distortion after set warms up	1)	check to see if suppressor grid of 78 r-f tube goes to 10-ohm tap on wire-wound resistor (*Part No. 66*) located on left end of chassis. If it does, move the suppressor grid lead from this tap to the *ground* end of resistor
Distortion at resonance peak of station	1)	realign No. 2 i-f stage
	2)	"shorted" secondary in i-f transformer *No. 28*
Distortion at low volume	1)	"shorted" condenser *No. 45*
Whistling or squealing	1)	"open" condenser *No. 6* or *No. 13*
Hum	1)	replace "leaky" electrolytic condenser marked Nos. 59 and 59A on (schematic wiring diagram)
Frequency drift (retuning receiver brings fading station back)	1)	see *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Dial troubles	1)	see *Note* (*I*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

PHILCO 37-660

Inoperative	1)	see *Note* (*F*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"grounded" resistor *No. 70*
	3)	"grounded" arm in volume control *No. 38*
	4)	"open" plate winding in oscillator transformer *No. 29*
	5)	"shorted" condensers *Nos. 21A, 60* and *68*
	6)	"shorted" section in condenser *No. 21*

(Cont'd)

PHILCO 37-660—*(Cont'd)*

Inoperative —*(Cont'd)*	7)	"shorted" condenser *No. 42* (indicated by narrow tuning meter shadow)
	8)	"shorted" condenser *No. 19* (indicated by wide tuning meter shadow)
	9)	"open" tuning meter *No. 34* (indicated by narrow tuning meter shadow)
	10)	"open" field coil *No. 69*
Inoperative, Intermittent reception	1)	"open" condenser *No. 58*
Inoperative, Intermittent reception (on broadcast band only)	1)	"open" oscillator transformer *No. 26*
Intermittent fading	1)	see the Case History for this trouble symptom listed for Philco 37-650
Weak reception	1)	see *Note* (*F*) and *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Distortion at resonance peak of station	1)	realign No. 2 i-f stage
	2)	"shorted" secondary in i-f transformer *No. 47*
Distortion at low volume	1)	"shorted" condenser *No. 58*
Distortion (intermittently after receiver heats up)	1)	check tapped wire-wound bias resistor No. 257. This is a dual resistor having 132 and 15-ohm sections. The 15-ohm section usually increases as much as 10 ohms in value. Replace the complete resistor (Part *No. 33-3278*)
Hum	1)	re-route filament wiring leads from the 6K5G first-audio tube to the 6J5G second-detector tube so they are as far as possible away from the 6K5G control-grid lead
Whistling or squealing	1)	"open" condensers *No. 7, 18* or *19*
	2)	if motorboating sound is heard, check for "open" condenser *No. 21*
Frequency drift (retuning receiver brings fading station back)	1)	see *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Dial troubles	1)	see *Note* (*I*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

PHILCO 37-665

Inoperative	1)	see *Note* (*F*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" tuning meter *No. 36* (indicated by narrow tuning meter shadow)
	3)	"shorted" condensers *Nos. 62, 66* and *75*
	4)	"shorted" condensers *Nos. 12, 13* and *16* (indicated by wide tuning meter shadow)
	5)	"grounded" arm in volume control *No. 47*
	6)	"shorted" condenser *No. 41* (indicated by narrow tuning meter shadow)
	7)	"shorted" condenser *No. 70* (indicated by overheated rectifier tube)
Inoperative, Intermittent reception	1)	"open" condenser *No. 57*

(Cont'd)

PHILCO 37-665—*(Cont'd)*

Inoperative, Intermittent reception (on broadcast band only)	1)	"open" oscillator transformer *No. 28*
Weak reception	1)	see *Note* (*F*) and *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Distortion at resonance peak of station	1) 2)	realign No. 2 i-f stage "shorted" secondary in i-f transformer *No. 40*
Distortion at low volume	1)	"shorted" condenser *No. 57*
Hum	1)	"open" section in condenser *No. 70*
Frequency drift (retuning receiver brings fading station back)	1)	see *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Dial troubles	1)	see *Note* (*I*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

PHILCO 37-670

Inoperative (all bands)	1)	see *Note* (*F*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"grounded" arm in volume control *No. 52*
	3)	"shorted" condensers *Nos. 73, 74, 40* and *69*
	4)	"shorted" section in condenser *No. 86* (indicated by overheated rectifier tube)
	5)	"shorted" condenser *No. 39* (indicated by narrow tuning meter shadow)
	6)	"shorted" condensers *No. 13* and *No. 20* (indicated by wide tuning meter shadow)
	7)	"open" tuning meter *No. 38* (indicated by narrow tuning meter shadow)
Inoperative on 4th band (7.35 to 11.6 mc.)	1)	test for short-circuited padding condenser. No. 27 (Philco bulletin 260 Part *No. 31-6108*)
Intermittent reception on 3rd band (4.7 to 7.4 mc.)	1)	test oscillator coil No. 24 for "open" primary (connection No. 2 to switch wafer terminal G-2) Oscillator coil Part *No. 32-2184*)
Inoperative, or broad tuning on bands 3, 4 and 5	1) 2)	test for intermittently open-circuiting 3,000-mmfd. condenser No. 30 in the detector-oscillator stage. Condenser is Part *No. 30-1028*) "shorted" condenser *No. 11*
Intermittent reception	1)	"open" condensers *Nos. 58, 62* and *63*
Weak reception	1)	see *Note* (*F*) and *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Distortion at resonance peak of station	1) 2)	realign No. 2 i-f stage "shorted" secondary in i-f transformer *No. 42*
Distortion at low volume	1)	"shorted" condensers *No. 63* and *No. 58*

(Cont'd)

PHILCO 37-670—*(Cont'd)*

Intermittent distortion	1)	test for "shorted" 6J5G tube (in second detector, AVC, first Audio, phase inverter or push-pull driver circuits). The tube causing the trouble can easily be detected by standing the chassis on end and "tapping" each tube individually
Intermittent fading	1)	see the Case History for this trouble symptom listed for Philco 37-650
Whistling or squealing	1) 2)	"open" condensers *No. 8* and *No. 21* if motorboating sound is heard, check for "open" condenser No. *37*
Hum	1)	"open" section in condenser *No. 86*
Frequency drift (retuning receiver brings fading station back)	1)	see *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Dial troubles	1)	see *Note* (*I*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Increasing sensitivity in early production receivers	1)	replace *yellow-red* range switch (Part *No. 42-1212*) with new *orange-green* type (Part *No. 42-1255*) The difference in these switches is in the lug arrangement of "D" wafer. In *42-1212* switches, condenser *No. 11* is wired from D2 to D4 as shown on the schematic diagram. Condenser *No. 11* on *42-1255* switches is wired from D10 to E10 and E10 is wired to F2. Lug D2 and D4 have been eliminated on *42-1225* to separate the plate circuit of the 6K7G and the grid of the 6A8G tube The color markings of each switch is located on the sleeve holding the wafers together

PHILCO 37-675

Inoperative	1)	see *Notes* (*F*) and (*H*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"grounded" arm in volume control *No. 97*
	3)	"shorted" section in condenser *No. 125* (indicated by overheated rectifier tube)
	4)	"shorted" section in condenser *No. 118*
	5)	"shorted" condensers *Nos. 26, 67, 103, 111* and *114*
	6)	"shorted" condenser *No. 88* (indicated by resistor *No. 117* section overheating)
	7)	"shorted" section in condenser *No. 118* (indicated by resistor *No. 117* section overheating)
	8)	"shorted" condenser *No. 13* (indicated by resistor *No. 15* overheating)
	9)	"shorted" condenser *No. 86* (indicated by resistor *No. 70* overheating)
	10)	"shorted" condenser *No. 36* (indicated by resistor *No. 33* burning)
	11)	"shorted" condenser *No. 45* (indicated by resistor *No. 124* overheating)
	12)	"shorted" condenser *No. 49* (indicated by resistors *No. 48* and *No. 50* overheating)
Inoperative (no voltage on 6A8G anode grid)	1)	"shorted" 0.05-mfd. condenser located near front section of range switch. Replace. Also check 4,000-ohm carbon resistor (connected from low-voltage end of filter choke) for change in value due to overheating because of this short. Replace

(Cont'd over)

PHILCO 37-675—*(Cont'd)*

Inoperative (over portion, or all, of broadcast band)	1)	"open" oscillator transformer *No. 37*
Weak reception	1)	see *Note* (*F*) and *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Distortion at resonance peak of station	1) 2)	realign No. 3 i-f stage "shorted" or "damp" magnetic tuning transformer *No. 84*
Distortion at low volume	1)	"shorted" condensers *No. 99* and *No. 103*
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" condensers *No. 99* and *No. 103*
Whistling or squealing	1) 2)	"open" condenser *No. 118* "open" condenser *No. 9* or *No. 28*
Hum	1)	"open" condensers *No. 125* and *No. 118*
Frequency drift (retuning receiver brings fading station back)	1) 2)	tighten set-screws in tuning condenser drive assembly replace tuning condenser drive coupling buckle
Oscillator tracks or drifts high (with osc. padder completely open, a 1500 kc signal appears at about 1600 kc on dial)	1)	"open" condensers *No. 31* and *No. 32*
Improper magnetic tuning action	1)	due to frequency drift in the magnetic tuning circuit. Replace the magnetic tuning transformer (Part *No. 32-2217*) with new type unit (Part *No. 32-2261*). A new transformer padder is designed to prevent this frequency drift
Magnetic tuning drifts	1)	replace magnetic tuning transformer *No. 84* with improved type
Magnetic tuning action inoperative	1)	"shorted" magnetic tuning switch *No. 122*
Dial troubles	1)	see *Note* (*K*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

PHILCO 37-680

Intermittent noise	1)	check wire-wound flexible resistors Nos. 53, 148 and 151. The electrical connections at the pigtail leads often loosen or stretch, causing noisy reception — especially when the receiver is operated at extreme bass response. Replace

PHILCO 37-690

Inoperative	1)	see *Notes* (*F*) and (*H*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

(Cont'd)

PHILCO 37-690—*(Cont'd)*

Inoperative —(*Cont'd*)	2)	"grounded" arm in volume control *No. 60*
	3)	"open" primary in input transformer *No. 156*
	4)	"shorted" section in condenser *No. 152* (indicated by overheated rectifier tube)
	5)	"shorted" section in condensers *No. 153* and *No. 99*
	6)	"shorted" section in condenser *No. 153* (indicated by resistor *No. 177* section overheating)
	7)	"shorted" condenser *No. 37* (indicated by resistor *No. 36* overheating)
	8)	"shorted" condenser *No. 18* (indicated by resistor *No. 111* overheating)
	9)	"shorted" condenser *No. 43* (indicated by resistors *No. 45* and *No. 25* overheating)
	10)	"shorted" condenser *No. 50* (indicated by resistors *No. 71* and *No. 83* overheating)
	11)	"shorted" condenser *No. 84* (indicated by resistor *No. 83* overheating)
	12)	"shorted" section in condenser *No. 88* (indicated by resistor *No. 177* section overheating)
	13)	"shorted" condensers *Nos. 10, 47* and *53*
	14)	"open" 1,000-ohm ½-watt resistor *No. 71*. Replace with 1-watt unit
Inoperative (over portion, or all, of broadcast band)	1)	"open" oscillator transformer *No. 33*
Weak reception	1)	see *Note* (*F*) and *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Intermittent reception	1)	"open" 1,000-ohm ½-watt resistor *No. 71*. Replace with 1-watt unit
Distortion at resonance peak of station	1) 2) 3)	replace magnetic tuning transformer *No. 119* if "shorted" or "damp" "shorted" condenser *No. 74* realign i-f system
Distortion at high volume, Weak, "tinny" signal	1) 2)	"shorted" section in condenser *No. 99* "shorted" primary in a-f transformer *No. 156*
Bass response poor	1)	"shorted" section in condenser *No. 99*, and "*shorted*" condenser *No. 112X*
Whistling or squealing	1)	if motorboating sound is also heard, check for "open" condenser *No. 153*
Rumble caused by extreme low-frequency station response	1)	change 490,000-ohm resistor *No. 100* (Part *No. 33-449339*) to new resistor (Part *No. 33-399339*). Also change 0.1-mfd. condenser *No. 112X* (Part *No. 30-4455*) to 0.13-mfd. condenser (Part *No. 30-4508*)
Rumbling and crackling with bass control set to *Max.* and with volume control *off*	1)	"faulty" bass amplifier audio choke *No. 104*. When replacing, mount new unit in the position that gives minimum hum
Crackling and popping noises	1)	"faulty" 1,000-ohm, ½-watt resistor *No. 71*. Replace with 1-watt unit

(Cont'd)

PHILCO 37-690—*(Cont'd)*

Noisy (pilot lamps flicker)	1)	disassemble 10-contact plug that connects tuner chassis to power supply and audio unit. Inspect for loose contacts in riveted connections between soldering lugs and contact pins in it. Remove base of plug from cable, solder riveted ends of pins to soldering lugs for better, more positive contact. Reassemble plug
Noisy operation	1)	change bias resistor *No. 177* (Part *No. 33-3302*). The 3,000-ohm and 2,240-ohm sections of this resistor should be replaced by new 2-tap resistor (Part *No. 33-3311*). The 80 and 300-ohm sections should be replaced by 75-ohm resistor (Part *No. 33-1229*) and 300-ohm resistor (Part *No. 33-1214*)—both bakelite encased units
Hum	1)	on receivers made prior to Run 3, reverse the connections from the second bass amplifier 6J5G tube to the cable socket contacts Nos. 11 and 18 in the power unit. The grid of the 6J5G tube was wired to the shield and the shielded wire was grounded. Therefore, make certain that the shielded wire goes to grid, and shield is grounded
	2)	"open" section in condenser *No. 152* or *No. 153*
Frequency drift (retuning receiver brings fading station back)	1)	tighten set-screws on tuning drive assembly
	2)	replace tuning condenser drive coupling buckle
	3)	partial "open" oscillator transformer *No. 33*
Oscillator tracks or drifts high (with oscillator padder completely open, a 1500 kc signal appears at about 1600 kc on dial)	1)	"open" condensers *No. 40* and *No. 41*
Magnetic tuning drifts	1)	replace magnetic tuning transformer *No. 119* with improved type
Magnetic tuning action inoperative	1)	"shorted" magnetic tuning switch *No. 145*
Dial troubles	1)	see *Note* (*K*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

PHILCO 37-2620

Inoperative	1)	see *Note* (*F*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"shorted" condensers *Nos. 12, 14* and *20*
	3)	"open" field coil *No. 63*
	4)	"open" primary in output transformer *No. 52*
	5)	"grounded" arm in volume control *No. 49*
	6)	"open" plate winding in oscillator transformer *No. 26*
	7)	"open" circuit in pick-up jack
Inoperative (on band *No. 3*)	1)	"shorted" condenser *No. 28*

(Cont'd)

PHILCO 37-2620—*(Cont'd)*

Inoperative, Intermittent reception (on broadcast band)	1)	"open" oscillator transformer *No. 24*
Weak reception	1)	see *Note* (*F*) and *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Distortion at resonance peak of station	1)	realign No. 2 i-f stage
	2)	"shorted" secondary in i-f transformer *No. 36*
Distortion, Weak, "tinny" signal	1)	"shorted" condenser *No. 48*
Frequency drift (retuning receiver brings fading station back)	1)	see *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Dial troubles	1)	see *Note* (*I*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

PHILCO 37-2650

Inoperative	1)	see *Note* (*F*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" tuning meter *No. 82* (indicated by narrow tuning meter shadow)
	3)	"shorted" condensers *Nos. 22, 63* and *64*
	4)	"shorted" section in condenser *No. 72* (indicated by overheated rectifier tube)
	5)	"shorted" condensers *No. 37* and *No. 12* (indicated by wide tuning meter shadow)
	6)	"grounded" arm in volume control *No. 54*
	7)	"open" circuit in pick-up jack
Inoperative (on *No. 3* and *No. 4* bands)	1)	"shorted" condenser *No. 20*
Inoperative, Intermittent reception (on broadcast band)	1)	"open" oscillator transformer *No. 27*
Weak reception	1)	see *Note* (*F*) and *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Distortion at resonance peak of station	1)	realign No. 2 i-f stage
	2)	"shorted" secondary in i-f transformer *No. 38*
Distortion at low volume	1)	"shorted" condenser *No. 46*
Hum	1)	"open" section in condenser *No. 72*
Frequency drift (retuning receiver brings fading station back)	1)	see *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Dial troubles	1)	see *Note* (*I*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

PHILCO 37-2670

Inoperative	1)	see *Note* (*F*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" tuning meter *No. 38* (indicated by narrow tuning meter shadow)
	3)	"shorted" condensers *Nos. 16X, 17X* and *20* (indicated by wide tuning meter shadow)
	4)	"shorted" condenser *No. 39* (indicated by narrow tuning meter shadow)
	5)	"shorted" section in condenser *No. 86* (indicated by overheated rectifier tube)
	6)	"shorted" section in condenser *No. 37*
	7)	"shorted" condensers *Nos. 40, 69, 73* and *74*
	8)	"grounded" arm in volume control *No. 52*
Inoperative (on *No. 4* and *No. 5* bands)	1)	"shorted" condenser *No. 30*
Inoperative, Intermittent reception	1)	"open" condensers *Nos. 58, 62* and *63*
Inoperative, Intermittent reception (on broadcast band only)	1)	"open" oscillator transformer *No. 23*
Weak reception	1)	see *Note* (*F*) and *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Distortion at resonance peak of station	1)	realign No. 2 i-f stage
	2)	"shorted" secondary in i-f transformer *No. 42*
Distortion at low volume	1)	"shorted" condensers *No. 63* and *No. 58*
Distortion (intermittent)	1)	intermittent "leakage" in second detector avc tube. Replace
Whistling or squealing	1)	if motorboating sound is heard, check for "open" condenser *No. 37*
Hum	1)	"open" section in condenser *No. 86*
Frequency drift (retuning receiver brings fading station back)	1)	see *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Dial troubles	1)	see *Note* (*I*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

PHILCO 38

Inoperative (entirely), Inoperative over a portion of the dial, Intermittent operation	1)	see remedies listed under *inoperative* or *intermittent operation* of Philco Model 19 receiver (except remedies 2 and 3)
	2)	low "A" or "B" battery resulting in failure of oscillator to function
	3)	change first det.-oscill. cathode bias resistor from 6,000 ohms to 4,000 ohms
	4)	permanent or intermittent short-circuit between i-f transformer leads as a result of the staples used to anchor these leads being driven into the wooden dowel so that they damage the insulation or touch at opposite ends. Replace with a new coil, making sure that this condition does not exist in new replacement

(Cont'd)

PHILCO 38—*(Cont'd)*

Inoperative (entirely), Inoperative over a portion of the dial, Intermittent operation —*(Cont'd)*	5)	take out all coils—r-f, oscillator and both i-f units and boil them in a 50-50 mixture of paraffin and beeswax for about 10 minutes. Give them a final dipping (for a hard covering) in a heated mixture of ½-lb. paraffin and ¼-lb. beeswax. Allow to cool, and install
	6)	clean the wipers on the gang condenser. Better still, install a piece of heavy shield braid from cond. gang to chassis
	7)	replace the 150-mfd. oscillator condenser —even if it checks O.K.
	8)	now rebalance and align the receiver
Weak reception	1)	if coils and tubes check O.K., check for "leaky" 2nd det. by-pass condenser
	2)	reverse primary connections of each i-f transformer and realign
Whistling or squealing	1)	replace the 0.5-megohm resistor in the second detector screen circuit with a 0.35- or 0.4-megohms, 1-watt unit
	2)	dress leads from No. 1 i-f transformer underneath shield mounted on *No. 18* padder
	3)	install a 0.25-mfd. condenser from plus filament terminal of '30 tube to ground
	4)	"open" condenser *No. 20*
	5)	check for reduced value in resistor *No. 21*
Distortion at high volume, Weak, "tinny" signal	1)	check input and output transformer primaries for insulation breakdown (indicated by "frying" noise)
	2)	check for "shorted" section in condenser *No. 20*
	3)	"leaky" coupling condenser in first audio stage
"Frying" noise	1)	check pilot light and socket for corroded contacts
	2)	insulation breakdown in primaries of input and output transformers
Noisy volume control (early receivers)	1)	disconnect condenser (40) from the top of the volume control, and connect it to the wiper arm terminal (center) instead. Disconnect resistor (39) from the resistor (39) from the bottom of the primary and secondary of the antenna transformer (2) and connect it to the top of the volume control
Improving reception	1)	it has been found advisable to increase the filament voltage of the tubes in early-production sets of this model by reducing the ballast tube shunt resistor to 20 ohms instead of its original 30-ohm value. This change has already been made in the later-run sets of this model
Dial slips	1)	nuts on the back of the drive shaft too tight. Loosen the nuts slightly to allow the rotor to turn more freely

PHILCO 38 (Code 123)

Inoperative	1)	"open" primary in input transformer *No. 29* or output transformer *No. 32*
	2)	"shorted" (one or more sections) condenser *No. 22*
	3)	"shorted" condenser *No. 12* (indicated by overheating of resistor *No. 13*
Inoperative (over portion of band)	1)	low "A" and "B" battery voltages
Intermittent reception	1)	"open" condenser *No. 27*
	2)	"open" i-f transformers *No. 17* and *No. 20*—see *Note* (*B*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

(Cont'd)

PHILCO 38 (Code 123)—*(Cont'd)*

Weak reception	1)	same remedies as listed for this trouble symptom under Philco 38 receiver
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" section in condenser *No. 22*
	2)	"shorted" primary in input transformer *No. 29* or output transformer *No. 32* (indicated by "frying" noise)
Noisy volume control	1)	same remedy as listed for this trouble symptom under Philco 38 receiver
Whistling or squealing	1)	see remedies listed for this trouble symptom under Philco 38 receiver
	2)	"open" section in condenser *No. 22*

PHILCO 38-1

Inoperative	1)	see *Notes* (*F*) and (*H*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"shorted" section in condenser *No. 77*
	3)	"shorted" condensers *Nos. 14, 16, 50, 67, 80, 88, 91* or *94*
	4)	"shorted" section in condenser *No. 102* (indicated by overheated rectifier tube)
	5)	"open" plate winding in oscillator transformer *No. 21*
Inoperative (over portion, or all, of broadcast band)	1)	"open" oscillator transformer *No. 19*
Weak reception	1)	see *Note* (*F*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" primary in r-f transformer *No. 12*
	3)	"open" resonance circuit in i-f transformer *No. 37* (indicated by no peak on padder—sometimes accompanied by oscillation or motorboating at low-frequency end of broadcast band)
Distortion at resonance peak of station	1)	"open" resonance circuit in i-f transformer *No. 38* (indicated by no peak on padder)
	2)	"shorted" compensating condenser *No. 4*
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" section in condenser *No. 77*
	2)	"shorted" condensers *No. 67* and *78*
Whistling (all productions up to Run 4)	1)	replace the 6U7G r-f tube with a 6K7G tube. Also lengthen the *green* wire connecting the screen contact of the 6U7G tube and condenser No. 6. Then redress this wire around the 6U7G socket toward the front of the r-f unit and then back to condenser No. 6. Be sure that the wire is as close to the base as possible. Remove the 250-mmfd. condenser entirely from 6U7G screen circuit
	2)	"open" condenser *No. 77*
Whistling and noise	1)	see *Note* (*M*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Hum	1)	"open" section in condenser *No. 102*
Magnetic tuning action inoperative	1)	"shorted" automatic magnetic tuning switch *No. 102*
Dial troubles	1)	see *Note* (*K*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

PHILCO 38-2

Inoperative	1)	see *Notes* (*F*) and (*H*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" plate winding in oscillator transformer *No. 21*
	3)	"shorted" condensers *Nos. 14, 16, 45, 60, 90* or *91*
	4)	"shorted" section in condenser *No. 76*
Inoperative (over portion, or all, of broadcast band)	1)	"open" oscillator transformer *No. 19*
Weak reception	1)	see *Note* (*F*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" primary in r-f transformer *No. 12*
	3)	"open" resonance circuit in i-f transformer *No. 37* (indicated by no peak on padder—sometimes accompanied by oscillation or motorboating at low-frequency end of broadcast band)
Distortion at resonance peak of station	1)	"shorted" compensating condenser *No. 4*
	2)	"open" resonance circuit in i-f transformer *No. 38* (indicated by no peak on padder—in Run #2 or above)
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" condensers *Nos. 58, 60, 78* or *79*
	2)	"shorted" section in condenser *No. 76*
	3)	check both output tubes. Unbalanced tubes will cause distortion
Whistling	1)	same remedy as listed for this trouble symptom under Philco 38-1 receiver
	2)	check for "shorted" condenser *No. 76*
Whistling and noise	1)	see *Note* (*M*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Hum	1)	"open" section in condenser *No. 76*
Magnetic tuning action inoperative	1)	"shorted" automatic magnetic tuning switch *No. 102*
Dial troubles	1)	see *Note* (*K*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

PHILCO 38-3

Inoperative	1)	see *Notes* (*H*) and (*F*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"shorted" condensers *Nos. 13, 57, 99, 82* and *86*
	3)	"shorted" section in condenser *No. 88* (indicated by overheated rectifier tube)
	4)	"open" plate winding in oscillator transformer *No. 32*
Inoperative (on broadcast band only)	1)	"open" oscillator transformer *No. 26*
Intermittent reception	1)	"open" condenser *No. 75*
Intermittent reception (on broadcast band only)	1)	"open" oscillator transformer *No. 26*
Weak reception	1)	see *Note* (*F*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

(Cont'd over)

PHILCO 38-3—*(Cont'd)*

Weak reception —*(Cont'd)*	2)	"open" primary in r-f transformer *No. 10*
	3)	"open" resonance circuit in i-f transformer *No. 45* (indicated by inability of padder to peak circuit)
Distortion at resonance peak of station	1)	realign No. 2 i-f stage
	2)	"shorted secondary in i-f transformer *No. 51*
Whistling and noise	1)	see *Note* (*M*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Hum	1)	"open" section in condenser *No. 88*
Magnetic tuning action inoperative	1)	"shorted" automatic magnetic tuning switch *No. 35*
Dial troubles	1)	see *Note* (*K*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

PHILCO 38-4, 38-5

(Model 38-4 Uses Cone-centric Automatic Tuning; Model 38-5 Uses Conventional Tuning)

Inoperative	1)	for Model 38-4 see *Note* (*J*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"shorted" condensers *No. 24* and *No. 25*
	3)	"shorted" section in condenser *No. 64* (indicated by overheated rectifier tube)
Inoperative (on broadcast band only—sometimes accompanied by motorboating sound)	1)	"shorted" compensating condenser *No. 14* (indicated by *positive* voltage on oscillator control grid). This is a mechanical fault, and jarring the compensating condenser or moving its terminals may clear the short; care should be taken not to jar or move terminals when testing
	2)	check 10,000-ohm 1-watt screen dropping resistor *No. 21*
	3)	"shorted" compensating condenser *No. 16*. This is a mechanical "short," and care should be taken not to jar or move terminal when testing
	4)	"inter-winding short" in r-f transformer *No. 7* (indicated by *positive* voltage on first detector control grid)
Intermittent reception	1)	check 10,000-ohm 1-watt screen dropping resistor *No. 21*
	2)	"open" condenser *No. 52*
Intermittent reception (on broadcast band only)	1)	"open" oscillator transformer *No. 15*
Weak reception	1)	"open" resonance circuit in i-f transformer *No. 23* (indicated by inability of padder to "peak" stage)
Distortion at resonance peak of station	1)	"open" resonance circuit in i-f transformer *No. 28* (indicated by inability of padder to "peak" stage)
Whistling or squealing	1)	see *Note* (*M*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Intermittent hum, Steady hum	1)	"open" section in condenser *No. 64*
Hum, when tuned to strong local only	1)	clean and tighten ground lug at transformer mounting bolt nearest tone control
Tunable hum, Station rumble	1)	change 0.01-mfd. condenser *No. 36* to a 0.0015-mfd. unit
	2)	change 40,000-ohm ½-watt resistor *No. 38* to a 32,000-ohm unit

(Cont'd)

PHILCO 38-4, 38-5—*(Cont'd)*

Frequency drift (at high-freq. end of broadcast band)	1)	replace compensating condenser *No. 16* with improved type (Part *No. 31-6206*) and connect two condensers (Part *No. 30-1097*) in parallel with the new condenser
Dial troubles (Model 38-5 only)	1)	see *Note* (*I*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Improving performance circuit on short-wave bands	1)	change 70,000-ohm resistor *No. 19* to one of 51,000-ohms (Part *No. 33-351339*)

PHILCO 38-7, 38-8, 38-9

Inoperative over broadcast band (38-9 receiver)	1)	"open" connection at one of the five lugs of trimmer condenser (7) (Part *No. 31-6188*). A loose connection in this condenser assembly will be the cause of no reception, or intermittent reception, on the broadcast band

(Model 38-7 employs Cone-centric Automatic Tuning; Model 38-8 employs Conventional Tuning with a Tuning Meter; Model 38-9 employs Conventional Tuning with no Tuning meter)

Inoperative	1)	"grounded" arm in volume control *No. 26*
	2)	"shorted" section in condenser *No. 11*
	3)	"shorted" condenser *No. 14*
	4)	on Model 38-7 see *Note* (*J*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	5)	on Models 38-8 and 38-9 especially, "open" primary in output transformer *No. 41*
Inoperative (on broadcast band only—sometimes accompanied by motorboating sound)	1)	"shorted" compensating condenser *No. 7* (indicated by *positive* voltage on oscillator control grid—see Case History of Model 38-4)
	2)	"shorted" compensating condenser *No. 7A* (on Model 38-7 only)—see Case History of Model 38-4
Intermittent reception (on broadcast band only)	1)	"open" oscillator transformer *No. 6*
Weak reception (especially on short-waves)	1)	realign i-f system (very critical on first stage)
Distortion at high volume, Weak, "tinny" signal	1)	"leaky" or "open" condenser *No. 11*
Distortion	1)	if reception is O.K. on weak stations without an antenna check for badly soldered connection, or broken lead to 110-mmfd. cond. between grid and plate of 6J5 detector
Whistling	1)	if whistle stops when 6A8G control grid cap is touched, check 0.05-mfd. AVC filter condenser located at band switch
	2)	"open" section in condenser *No. 11*
Whistling and noise	1)	see *Note* (*M*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Whistling (only at high volume)	1)	shunt a 0.0005-mfd. condenser from 6K5G grid to ground in Model 38-8 receiver
Intermittent hum	1)	"open" section in condenser *No. 11*

(Cont'd)

PHILCO 38-7, 38-8, 38-9—*(Cont'd)*

Tunable hum, Station rumble, Excessive "bass" response	1)	replace 0.01-mfd. condenser *No. 24* with an 0.001-mfd. condenser (Part *No. 30-4201*)
	2)	replace 0.06-mfd. condenser *No. 38* with an 0.01-mfd. condenser (Part No. *30-4479*)
	3)	replace 51,000-ohm resistor *No. 32* with a 40,000-ohm ½-watt resistor (Part *No. 33-340339*)
Frequency drift (on Model 38-7 only)	1)	replace compensating condenser *No. 7A* with improved type (Part *No. 31-6206*) and connect two condensers (Part *No. 30-1097*) in parallel with the new condenser
Dial troubles (models 38-8 and 38-9)	1)	see *Note (I)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Improving performance of oscillator circuit on short-wave bands	1)	connect a 20-ohm resistor (Part *No. 33-020339*) in series with the cathode of the 6A8G det.-osc. tube
To increase sensitivity of shadow-meter in Model 38-8 receiver	1)	replace 10,000-ohm resistor *No. 12* with a 13,000-ohm unit (Part *No. 33-313639*). Replace 0.05-mfd. condenser *No. 17* with a 0.25-mfd. condenser (Part *No. 33-313639*)
To increase the audio response in the high-frequencies (Model 38-8 receiver)	1)	replace 0.008-mfd. condenser *No. 40* with a 0.004-mfd. condenser (Part *No. 30-4456*)

PHILCO 38-10

Inoperative	1)	"shorted" condenser *No. 17*
	2)	"grounded" arm in volume control *No. 25*
	3)	"shorted" section in condenser *No. 12*
	4)	"open" primary in output transformer *No. 40*
Inoperative (on broadcast band only)	1)	"shorted" compensating condenser *No. 14* (indicated by positive voltage on oscillator control grid)—see Case History of Philco 38-4 receiver
	2)	check for "open" r-f coil for this band
Intermittent reception (on broadcast band only)	1)	"open" oscillator transformer *No. 6*
Weak reception (especially on short-waves)	1)	realign i-f system (very critical on first stage)
Distortion at high volume, Weak, "tinny" signal	1)	"leaky" condenser *No. 12*
Whistling and noise	1)	see *Note (M)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Whistling	1)	"open" section in condenser *No. 12*
Hum	1)	"open" section in condenser *No. 12*
Dial troubles	1)	see *Note (I)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
To provide uniform performance of the oscillator circuit	1)	connect a 20-ohm resistor (Part *No. 33-020339*) in series with the cathode of the 6A8G det.-osc. tube

PHILCO 38-12

Inoperative	1)	"inter-winding short" in oscillator transformer *No. 7*
	2)	"shorted" compensating condenser *No. 3B* (this short is usually difficult to see, and it is usually best to burn it out by disconnecting the coils and applying a high-voltage across it)
Intermittent reception	1)	"shorted" oscillator trimmer located on top of gang condenser
Weak reception	1)	check for broken lead between tuning condenser and r-f transformer *No. 1* at top of coil
	2)	"shorted" compensating condenser *No. 3A* (this short is usually difficult to see, and it is usually best to burn it out by disconnecting the coils and applying a high-voltage across it)
	3)	"shorted" condensers *No. 10* and *No. 21*
Whistling or squealing	1)	"open" condenser *No. 26* (sometimes indicated by motorboating sound)
Hum	1)	dress *green* wires from diodes of 75 tube to the 2nd i-f transformer away from filament prongs of this tube
	2)	the grid lead of 75 tube should be dressed toward the back of chassis and between the tube and shield
	3)	dress the *brown* wire connecting 51,000-ohm resistor *No. 12* to the high side of volume control under the coil of the 2nd i-f transformer *No. 12*
High noise level	1)	replace 70-ohm resistance *No. 24* with a 100-ohm unit
Improving performance of receiver	1)	replace 0.05-mfd. tubular condenser *No. 2* with a 0.05-mfd. condenser (Part *No. 30-4519*). Replace 0.01-mfd. condenser *No. 19* with a 0.01-mfd. condenser (Part *No. 30-4514*)

PHILCO 38-14 (Codes 121 and 124)

Inoperative, Intermittent reception	1)	"shorted" condensers *No. 25* and *No. 9*
	2)	"shorted" compensating condenser *No. 4B*—see Case History of Philco 38-12 receiver
	3)	"shorted" compensating condenser *No. 12*
Inoperative, Intermittent reception (on broadcast band only)	1)	"open" or "inter-winding short" in oscillator transformer *No. 11*
Weak reception (sometimes intermittent)	1)	"open" transformer *No. 8*
	2)	check compensating condenser *No. 4A*—see Case History of Philco 38-12 receiver
Weak, "tinny" signal (sometimes intermittent)	1)	"open" or "grounded" coil assembly *No. 34* in hum-bucking coil located inside speaker field
Whistling or squealing	1)	"open" condenser *No. 28* (sometimes indicated by motorboating sound)
Microphonic	1)	see that tuning condenser assembly floats freely on its rubber mountings
	2)	run a drop of solder in each corner of padder *No. 4B* also on padder underneath oscillator tuning condenser (reached by turning chassis upside down)
	3)	as a last resort replace entire tuning condenser assembly
Noisy operation	1)	change 120,000-ohm grid leak of 6A7 oscillator to a unit of about 50,000-ohms

(Cont'd over)

PHILCO 38-14 (Codes 121 and 124)—*(Cont'd)*

Hum modulation	1)	in productions previous to Run 4 of Code 121 receivers change 16-mfd. electrolytic condenser (32) to 40-mfd. unit (Part *No. 30-2237*). In Code 124 receivers change 16-mfd. electrolytic condenser (32) to 40-mfd. unit (Part *No. 30-2256*)
	2)	replace 0.01-mfd. condenser connected from 25Z5 rectifier cathode to one side of line, with a 0.05-mfd. 600-volt unit

PHILCO 38-15 (Codes 121 and 124)

Inoperative	1)	"shorted" section in condenser *No. 31*
	2)	"shorted" compensating condenser *No. 4B*—see Case History of Philco 38-12 receiver
	3)	"inter-winding short" in oscillator transformer *No. 8* (indicated by positive voltage on oscillator control grid)
	4)	"shorted" condensers *Nos. 18, 27* and *30*
Inoperative (on broadcast band only)	1)	"shorted" low-frequency compensating condenser *No. 9*
Hum	1)	"open" section in condenser *No. 31*
Whistling or squealing	1)	"open" condenser *No. 30*
Microphonic	1)	refer this trouble symptom listed under Model 38-14
Improving stability of receiver operation	1)	change second i-f transformer assembly from Part. *No. 32-2674* to Part *No. 32-2944*. Condensers 15B and 15C are part of the compensator in new units

PHILCO 38-22, 38-23

(Model 38-22 employs Cone-centric Automatic Tuning; Model 38-23 employs Conventional Tuning)

Inoperative	1)	on Model 38-22—see *Note (J)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" primary in input transformer *No. 31* and output transformer *No. 39*
	3)	"shorted" section in condenser *No. 34* (indicated by choke *No. 46* or resistor *No. 45* overheating)
	4)	"shorted" condensers *No. 15* and *No. 50*
	5)	"grounded" arm in volume control *No. 27*
	6)	"open" oscillator transformers *No. 8* and *No. 9*
	7)	"shorted" compensating condenser *No. 10* (indicated by *positive* voltage on oscillator control grid)—see Case History of Philco 38-4 receiver
	8)	on Model 38-22 only, "shorted" compensating condenser *No. 10B*—also see Case History of Philco 38-4 receiver
Weak reception (especially on short-wave reception)	1)	realign i-f system (very critical on first stage)
Distortion at resonance peak of station	1)	realign No. 2 i-f stage
Distortion at high volume, Weak, "tinny" signal	1)	"open" or "leaky" condenser *No. 34*
Whistling and noise	1)	see *Note (M)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

(Cont'd)

PHILCO 38-22, 38-23—*(Cont'd)*

Whistling or squealing	1)	"open" section in condenser *No. 34*
Hum	1)	"open" section in condenser *No. 34*
	2)	dress *red* and *brown* leads from No. 2 i-f transformer *No. 18* as far away as possible from cable and pilot lamp leads at rear of chassis
Frequency drift (at high-freq. end of broadcast band)	1)	on Model 38-22 only. Replace compensating condenser *No. 10B* with improved type (Part *No. 31-6206*). In addition, a new thermal compensator (Part *No. 31-6227*) should be connected in parallel with compensator *No. 10B* and mounted in back of the 6A8G det.-osc. tube socket
Pilot light burns out	1)	install a 75-ohm resistor across pilot lamp
Pilot light shunt resistor "blows"	1)	this resistor is contained in a can together with the line resistor in series with the filaments of the tubes in this set. Since it is only the shunt resistor that blows, it is best to use a 15-ohm 5-watt resistor and shunt it across the pilot light

PHILCO 38-33 Battery Operated Receiver

See also Case Histories listed for Philco 37-33 Battery Operated Receiver

Inoperative	1)	inspect to see if bare wire leading to tuning condenser wiper spring "shorts" to stator plates. Wire is under tuning condenser and goes through hole in chassis
	2)	"shorted" condensers *Nos. 30, 31, 34* and *14*
	3)	"shorted" condenser *No. 9* (indicated by *positive* voltage on oscillator control grid)
Inoperative, Intermittent reception	1)	"open" oscillator transformer *No. 7*
Weak reception	1)	realign first i-f stage (very critical)
	2)	"inter-winding short" in Ant. transformer *No. 3*
Distortion at resonance peak of station	1)	realign second i-f stage
Distortion at low volume	1)	"shorted" condensers *No. 21* and *No. 26*
Weak, "tinny" signals (in "B" models)	1)	may be due to speaker and can be corrected by unsoldering the armature tension spring and increasing its tension, then resoldering
Whistling or squealing	1)	"open" condenser *No. 14*
Microphonic howl	1)	remove tube shield from the 1D7G tube

PHILCO 38-34 Battery Operated Receiver

Inoperative	1)	"shorted" condensers *Nos. 18, 38* and *28*
	2)	inoperative vibrator
	3)	"shorted" condensers *No. 51* and *No. 46* (indicated by burnt vibrator armature)

(Cont'd)

PHILCO 38-34 Battery Operated Receiver—*(Cont'd)*

Inoperative —*(Cont'd)*	4)	"shorted" condenser *No. 42* (indicated by choke *No. 47* burning)
	5)	"shorted" condenser *No. 8* (indicated by *positive* voltage on oscillator control grid)
	6)	pilot light bulb burned out
Inoperative, Intermittent reception	1)	"open" oscillator transformer *No. 5*
	2)	pilot light bulb burned out
Weak reception	1)	realign first i-f stage (very critical)
	2)	pilot light bulb burned out
Whistling or squealing	1)	"open" section in condenser *No. 42*
Distortion accompanied by intermittent reception at the low-frequency end of broadcast band	1)	this condition will result if the pilot light burns out, since then the filament current of the tubes is decreased, causing subnormal operation of the tubes. Replace the pilot light
Distortion at resonance peak of station	1)	realign second i-f stage
Distortion at low volume	1)	"shorted" condensers *No. 35* and *No. 28*
Distortion	1)	"open" pilot lamp
Hum	1)	"open" section in condenser *No. 42*
	2)	lengthen *red* wire which connects the "on-off" switch with the filament of the 6Q7G tube so that it follows the rear, side and front of chassis close to the base

PHILCO 38-35

Inoperative	1)	"shorted" condenser *No. 7* (indicated by *positive* voltage on oscillator control grid)
	2)	"shorted" section in condenser *No. 19*
	3)	"shorted" condensers *No. 23* and *No. 14*
	4)	vibrator inoperative
	5)	"shorted" condenser *No. 43* (indicated by burnt vibrator armature)
Inoperative, Intermittent reception (on broadcast band only)	1)	"open" oscillator transformer *No. 6*
Weak reception	1)	realign i-f system (very critical on first stage)
Distortion at resonance peak of station	1)	realign No. 2 i-f stage
Whistling or squealing	1)	"open" section in condenser *No. 19*
Hum	1)	on productions previous to Run 3, this trouble can be corrected by lengthening the *red* wire which connects the filament of the 6Q7G tube to the on-off switch. Redress the wire so it follows the rear, side and front channels of the chassis near the base instead of being connected directly from the switch to the socket contact
	2)	"open" section in condenser *No. 19*
How to reduce battery current consumption considerably	1)	change the entire tube complement as follows:

Original	*New*
6A8G	6D8G
6K7G	6S7G
6Q7G	6T7G
6K6G	6G6G
6X5G	6ZY5G

This change will be accompanied by only a slight reduction in sensitivity

PHILCO 38-38 Battery Operated Receiver

Inoperative	1)	"shorted" compensating condenser *No. 7* (indicated by *positive* voltage on oscillator control grid)—see Case Histories of Model 38-4
	2)	"grounded" arm in volume control *No. 19*
	3)	"shorted" condensers *Nos. 10, 33, 34* and *26*
	4)	"shorted" primary in input transformer *No. 32* and output transformer *No. 35* (sometimes indicated by "frying" noise)
	5)	"shorted" section in condenser *No. 13*
Inoperative (on broadcast band only)	1)	"open" oscillator transformer *No. 6*
Intermittent reception	1)	clean band switch contacts. Tighten rivets in switch
Weak reception (especially on short-waves)	1)	realign i-f system (very critical on first stage)
	2)	if "shorting" out avc restores normal reception, replace 1C7G tube with a 1D7G tube
Distortion at resonance peak of station	1)	realign No. 2 i-f stage
Weak, "tinny" signal	1)	"shorted" condensers *No. 33* and *No. 34*
	2)	"shorted" insulation on primary windings in input transformer *No. 32* and output transformer *No. 35*
Whistling and noise	1)	see *Note (M)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Whistling or squealing	1)	"open" condenser *No. 13* (sometimes causing motorboating sound)
	2)	low "B" and "C" battery voltages
To decrease drain on "B" and "C" batteries in receivers previous to Run #4	1)	replace 900-ohm resistor *No. 38* with a 2,000-ohm resistor (Part *No. 33-220339*)

PHILCO 38-39

Inoperative	1)	"shorted" compensating condenser *No. 9* (indicated by *positive* voltage on oscillator grid)
	2)	"shorted" section in condenser *No. 15* (indicated by choke *No. 50* burning)
	3)	vibrator inoperative
	4)	"shorted" primary in input transformer *No. 37* and output transformer *No. 40* (sometimes indicated by "frying" noise)
	5)	"shorted" condensers *No. 24* and *No. 13*
	6)	"shorted" condensers *No. 49* and *No. 53* (indicated by burnt vibrator armature)
Inoperative, Intermittent reception	1)	"open" oscillator transformer *No. 8*
Weak reception	1)	realign i-f system (very critical on first stage)
Whistling and noise	1)	see *Note (M)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Whistling or squealing	1)	"open" condenser *No. 15*
Hum	1)	"open" section in condenser *No. 15*
Distortion at resonance peak of station	1)	realign second i-f stage

(Cont'd over)

PHILCO 38-39—*(Cont'd)*

Distortion accompanied by intermittent reception at the low-frequency end of the broadcast band	1)	this condition will result if the pilot light burns out, since then the filament current of the tubes is decreased, causing subnormal operation of the tubes. Replace the pilot light
Buzz at maximum volume	1)	change 11.7-ohm resistor No. 22 to one of 12.3 ohms. Change the 2-megohm resistor No. 30 to one of 4 megohms. Change the 160,000-ohm resistor No. 27 to one of 240,000 ohms

PHILCO 38-40

Inoperative	1)	"shorted" compensating condenser *No. 7* (indicated by *positive* voltage on oscillator control grid)
	2)	"shorted" section in condenser *No. 14*
	3)	vibrator inoperative
	4)	"shorted" condensers *No. 50* and *No. 56* (indicated by burnt vibrator armature)
	5)	"grounded" arm in volume control *No. 20*
	6)	"shorted" condenser *No. 15*
Inoperative, Intermittent reception	1)	"open" oscillator transformer *No. 6*
Weak reception	1)	realign i-f system (very critical on first stage)
Distortion, Weak, "tinny" signal	1)	"leaky" condenser *No. 14*
Distortion at resonance peak of station	1)	realign No. 2 i-f stage
Whistling and noise	1)	see *Note (M)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Whistling or squealing	1)	"open" section in condenser *No. 14*
Hum	1)	"open" condenser *No. 14*
To improve action of oscillator circuit	1)	replace oscillator transformer *No. 5* (range 2) with new transformer (Part *No. 32-2897*). Replace 8,000-ohm resistor *No. 10* with 5,000-ohm resistor (Part *No. 33-250339*). Replace 8-8 mfd. electrolytic condenser *No. 14* with new 8-8 mfd. condenser (Part *No. 30-2291*)
How to reduce battery current consumption considerably	1)	change the entire tube complement as follows:

Original	*New*
6A8G	6D8G
6K7G	6S7G
6J5G	6L5G
6K5G	6T7G
6K6G	6G6G
6X5G	6ZY5G

This change will be accompanied by only a slight reduction in sensitivity

PHILCO 38-60

Inoperative	1)	"shorted" condenser *No. 15*
	2)	"grounded" arm in volume control *No. 22*
	3)	"open" primary in i-f transformer *No. 14*
	4)	"shorted" compensating condenser *No. 9*
	5)	"open" primary in output transformer *No. 33*

(Cont'd)

PHILCO 38-60—*(Cont'd)*

Inoperative, Intermittent reception	1)	"open" oscillator transformer *No. 10*
Distortion at resonance peak of station	1)	realign second i-f stage
Distortion, Weak, "tinny" signal	1)	"shorted" condenser *No. 31*

PHILCO 38-62

See also Case Histories listed for Philco 37-62 receiver

Signal fades out a few seconds after set has completely warmed up	1)	"shorted" primary to secondary windings in antenna coil. Repair or replace coil

PHILCO 38-89

Inoperative	1)	"grounded" arm in volume control *No. 28*
	2)	"shorted" condensers *Nos. 17, 21* or *40*
	3)	"open" primary in output transformer *No. 41*
Inoperative (over portion, or all, of broadcast band)	1)	"open" oscillator transformer *No. 11*
Intermittent reception	1)	"open" oscillator transformer *No. 11*
Weak reception	1)	"open" r-f choke *No. 8*
Distortion at resonance peak of station	1)	realign second i-f stage
Distortion at low volume	1)	"shorted" condenser *No. 36*
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 40*
	2)	"shorted" condenser *No. 36*

PHILCO 38-93

Same Case Histories as those listed for Philco 37-93 receiver

PHILCO 38-116 (Code 121)

Inoperative	1)	see *Notes (F)* and *(H)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"shorted" condenser *No. 10* (indicated by resistor *No. 63* overheating)
	3)	"shorted" condenser *No. 60* (indicated by resistor *No. 61* overheating)
	4)	"shorted" condenser *No. 64* and "shorted" section in condenser *No. 80* (indicated by resistor *No. 79* overheating)
	5)	"shorted" condenser *No. 75* (indicated by resistor *No. 62* overheating)
	6)	"shorted" condenser *No. 76* (indicated by resistor *No. 77* overheating)
	7)	"shorted" condenser *No. 35* (indicated by resistor *No. 30* burning)
	8)	"shorted" condenser *No. 56* (indicated by resistors *No. 57* and *No. 58* overheating)
	9)	"shorted" section in condenser *No. 80* (sometimes indicated by "frying" noise)

(Cont'd)

PHILCO 38-116 (Code 121)—*(Cont'd)*

Inoperative —*(Cont'd)*	10)	"shorted" sections in condenser *No. 59* or *No. 80* (indicated by resistor *No. 137* overheating)
	11)	"shorted" section in condenser *No. 140* (indicated by overheated rectifier tube)
	12)	"shorted" condensers *Nos. 47, 110, 118* or *119*
Inoperative, Intermittent reception (on broadcast band)	1)	"open" oscillator transformer *No. 38*
Weak reception	1)	see *Note* (*F*) and *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Distortion, Weak, "tinny" signal	1)	"shorted" condenser *No. 110*
Whistling or squealing	1)	"open" section in condenser *No. 80*
Hum	1)	"open" section in condensers *No. 80* or *No. 140*
Frequency drift (retuning receiver brings fading station back)	1)	replace tuning condenser drive coupling buckle
Oscillator tracks or drifts high (with osc. padder completely open, a 1500 kc signal appears at about 1600 kc)	1)	"open" condensers *No. 31* and *No. 32*
Magnetic action inoperative	1)	"shorted" automatic magnetic tuning switch *No. 99*
	2)	if set functions normally on all bands, check for "open" 10,000-ohm ½-watt 6A8G plate supply resistor. Replace with 1-watt unit
To improve "holding" characteristics of magnetic tuning circuit	1)	connect a 5-mmfd. condenser (Part *No. 30-1097*) from 6J5G discriminator tube grid (marked No. 2 on schematic diagram) to ground
To prevent audio leakage when volume control is "off" (in Run #1)	1)	audio shorting wire (*green* wire) of switch *No. 102* should be wired to the movable contact of volume control *No.* 101 instead of to the "high" side
Dial troubles	1)	see *Note* (*K*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

PHILCO 38-116 (Code 125)

Inoperative	1)	see *Notes* (*F*) and (*H*) under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"shorted" section in condensers *No. 70* and *No. 46* (indicated by resistor *No. 69* overheating)
	3)	"shorted" condenser *No. 9* (indicated by resistor *No. 45* overheating)
	4)	"shorted" condenser *No. 68* (indicated by resistor *No. 50* overheating)
	5)	"shorted" condenser *No. 44* (indicated by resistor *No. 47* overheating)
	6)	"shorted" section in condenser *No. 70*

(Cont'd)

PHILCO 38-116 (Code 125)—*(Cont'd)*

Inoperative —*(Cont'd)*		(indicated by resistor *No. 117* overheating and sometimes by "frying" noise)
	7)	"shorted" condenser *No. 42* and "shorted" section in condenser *No. 70*
	8)	"shorted" section in condenser *No. 123* (indicated by overheated rectifier tube)
	9)	"shorted" condensers *No. 67* and *No. 82*
Intermittent reception (over portion, or all, of broadcast band)	1)	"open" oscillator transformer *No. 30*
	2)	"partially open" resistor *No. 35*
	3)	"shorted" compensating condenser *No. 34*
Weak reception	1)	see *Note* (*F*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" primary in r-f transformer *No. 13*
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 82*
Whistling, Improving performance at 18 mc	1)	connect a 100-ohm resistor between the 6A8G oscillator anode and the 6N7G plate. This replaces the original *brown* wire, which should be removed
Hum	1)	dress all leads from tone control so they are clear of the a-c switch and wires
	2)	"open" section in condensers *No. 123* and *No. 70*
Oscillator tracks or drifts high (with oscillator padder completely open, a 1500 kc signal appears at about 1600 kc)	1)	"open" condensers *No. 26* and *No. 27*
Magnetic tuning action inoperative	1)	"shorted" automatic magnetic tuning switch *No. 97*
Dial troubles	1)	see *Note* (*K*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

PHILCO 38-116X

AFC does not function	1)	check 6N7G tube and socket located at front of receiver
	2)	also check the 1,000 kc padder

PHILCO 38-620 (Codes 121 and 125)

Inoperative	1)	see *Note* (*F*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" primary in output transformer *No. 53*
	3)	"open" field coil *No. 59*
	4)	"shorted" condensers *No. 13* and *No. 28*
	5)	"open" plate winding in oscillator transformer *No. 19*
Inoperative, Intermittent reception (on broadcast band only)	1)	"open" oscillator transformer *No. 17*
Weak reception	1)	see *Note* (*F*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" primary in r-f transformer *No. 10*

(Cont'd over)

PHILCO 38-620 (Codes 121 and 125)—*(Cont'd)*

Distortion at resonance peak of station	1)	realign second i-f stage
Distortion at low volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 49*
Frequency drift (retuning receiver brings fading station back)	1)	see *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Dial troubles	1)	see *Note* (*I*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

PHILCO 38-623

Inoperative	1)	see *Note* (*F*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" plate winding in oscillator transformer *No. 20*
	3)	"grounded" arm in volume control *No. 36*
	4)	"shorted" condensers *Nos. 14, 55, 56, 47* and *17*
	5)	"shorted" primary in output transformer *No. 57* and input transformer *No. 54* (indicated by "frying" noise)
	6)	"shorted" section in condenser *No. 60*
Inoperative, Intermittent reception (on broadcast band only)	1)	"open" oscillator transformer *No. 18*
Weak reception	1)	see *Note* (*F*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" primary in r-f transformer *No. 12*
Distortion at resonance peak of station	1)	realign second i-f stage
Distortion at low volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 46*
	2)	"shorted" primary in input transformer *No. 54*
Whistling or squealing	1)	"open" condenser *No. 60*
	2)	low "B" and "C" battery voltages
Frequency drift (retuning receiver brings fading station back)	1)	see *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Dial troubles	1)	see *Note* (*I*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Improving performance	1)	on receivers made previous to Run 2, change resistor (42) to a 20,000-ohm unit (Part *No. 33-320339*). The new resistor may be removed from the 90-volt wire of the battery cable. The battery cable assembly should also be changed from Part *No. 41-3198* to Part *No. 41-3394*

PHILCO 38-624 (Codes 121, 125)

Inoperative	1)	see *Note* (*F*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" plate winding in oscillator transformer *No. 22*
	3)	"shorted" condensers *Nos. 26, 14, 30* and *32*
	4)	"shorted" condenser *No. 66* (indicated by choke *No. 68* burning)
	5)	vibrator inoperative
	6)	"shorted" condensers *No. 72* and *No. 73* (indicated by burnt vibrator armature)
	7)	"open" primaries in input transformer *No. 58* and output transformer *No. 62*
Inoperative (on broadcast band only)	1)	"open" oscillator transformer *No. 20*
Weak reception	1)	see *Note* (*F*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" primary in r-f transformer *No. 11*
Distortion at resonance peak of station	1)	realign second i-f stage
Distortion at low volume	1)	"shorted" condenser *No. 51*
Distortion at high volume, Weak, "tinny" signal	1)	"leaky" condenser *No. 26*
	2)	"shorted" condenser *No. 51*
Whistling or squealing	1)	"open" condenser *No. 26*
Hum	1)	hum may be reduced in receivers made previous to Run 6 by making the following changes: (*a*) change 1-megohm resistor No. 36 (Part *No. 33-510339*) to new Part *No. 33-475339* (*b*) change resistor No. 47 (Part *No. 33-510339*) to new Part *No. 33-540339*
	2)	"open" condenser *No. 66*
Frequency drift (retuning receiver brings fading station back)	1)	see *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Dial troubles	1)	see *Note* (*I*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

PHILCO 38-630

Inoperative on all bands	1)	"short" in the compensating condenser assembly, Part *No. 31-6160*. It will be found in the r-f section of the set and will be indicated by the B+ voltage at the grid of the 6A8G tube. Replacement of the complete condenser assembly will correct this trouble

PHILCO 38-643

Same Case Histories as those listed for Philco 37-643 receiver

PHILCO 38-665

Same Case Histories as those listed for Philco 37-665 receiver

PHILCO 38-690

Inoperative	1)	see *Notes* (*F*) and (*H*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"shorted" section in condensers *No. 164* or *No. 110*
	3)	"shorted" section in condenser *No. 169* (indicated by overheated rectifier tube)
	4)	"shorted" condenser *No. 18* (indicated by resistor *No. 65* overheating)
	5)	"shorted" condenser *No. 89* (indicated by resistor *No. 163* section overheating)
	6)	"shorted" condenser *No. 54* (indicated by resistor *No. 69* overheating)
	7)	"shorted" condenser *No. 21* (indicated by resistor *No. 64* overheating)
	8)	"shorted" condenser *No. 45* (indicated by resistor *No. 44* overheating)
	9)	"shorted" condenser *No. 65X* (indicated by resistor *No. 163* section overheating)
	10)	"shorted" condenser *No. 61*
Inoperative, Intermittent reception (on broadcast band)	1)	"open" oscillator transformer *No. 34*
Weak reception	1)	see *Note* (*F*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"shorted" condenser *No. 55*
	3)	"open" primary in r-f transformer *No. 14*
Distortion at resonance peak of station	1)	"shorted" condenser *No. 55*
	2)	realign i-f system
	3)	"shorted" or "open" secondary in magnetic tuning transformer *No. 85*. Replace
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" section in condenser *No. 110*
Bass response poor	1)	"shorted" section in condenser *No. 110*
Hum	1)	"open" section in condensers *No. 169* and *No. 164*
	2)	see that condenser *No. 123* is placed as far as possible away from the a-c switch of the audio bass control *No. 122*
Oscillator tracks or drifts high (with osc. padder completely open, a 1500 kc signal appears at about 1600 kc)	1)	"open" condensers *No. 29* and *No. 30*
Frequency drift (retuning receiver brings fading station back)	1)	"partial open" oscillator transformer *No. 34*
	2)	replace tuning condenser drive coupling buckle
Magnetic tuning action inoperative	1)	"shorted" automatic magnetic tuning switch *No. 109*
Dial troubles	1)	see *Note* (*K*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Whistling, Motorboating sound	1)	"open" condenser *No. 164*

(Cont'd)

PHILCO 38-690—*(Cont'd)*

Whistling, Improving performance at 18 mc.	1)	connect a 100-ohm resistor between the 6A8G oscillator anode and the 6N7G plate. The resistor replaces the original *brown* wire, which should be removed

PHILCO 38-2620 (Code 325)

Inoperative	1)	see *Note* (*F*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" primary in output transformer *No. 49*
	3)	"open" field coil *No. 67*
	4)	"open" plate winding in oscillator transformer *No. 29*
	5)	"open" circuit in pick-up jack
	6)	"shorted" condenser *No. 21* (indicated by *positive* voltage on first detector control grid)
	7)	"shorted" condensers *No. 24* and *No. 37*
Inoperative (on broadcast band only)	1)	"open" oscillator transformer *No. 28*
Intermittent reception	1)	"open" condenser *No. 48* (on some runs only)
Weak reception	1)	see *Note* (*F*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" primary in r-f transformer *No. 16*
Distortion at resonance peak of station	1)	realign second i-f stage
Distortion at low volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 48*
Frequency drift (retuning receiver brings fading station back)	1)	see *Note* (*G*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Dial troubles	1)	see *Note* (*I*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

PHILCO 38-2650

Same Case Histories as those listed for Philco 37-2620 receiver

PHILCO 38-2670

Same Case Histories as those listed for Philco 37-2670 receiver

PHILCO 39

Inoperative	1)	"shorted" section in condenser *No. 20*
	2)	"open" primary in input transformer *No. 37* and output transformer *No. 39*
	3)	"shorted" condenser *No. 15* (indicated by overheating of resistor *No. 19*)
Inoperative (over portion of band)	1)	low "A" and "B" battery voltages
Intermittent reception	1)	"open" condensers *No. 28* or *No. 33* — see *Note* (*A*) listed under "Philco Receiver General Servicing Data' at beginning of Philco case histories
	2)	"open" in i-f transformers *No. 17* and *No. 22* — see *Note* (*B*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	3)	intermittent "open" in oscillator transformer—check all soldered joints

(Cont'd over)

PHILCO 39—*(Cont'd)*

Distortion at low volume	1)	"shorted" condenser *No. 33*
Distortion at high volume, Weak, "tinny" signal	1) 2)	"shorted" section in condenser *No. 20* "shorted" primary in input transformer *No. 37* and output transformer *No. 39* (indicated by "frying" noise)
Whistling or squealing	1) 2)	"open" condenser *No. 41* "open" section in condenser *No. 20*

PHILCO 39-6, 39-7 (Code 121)

(Model 39-7 employs Electrical Push-Button tuning; Model 39-6 employs Conventional tuning)

Inoperative	1)	see *Note* (*N*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories (indicated by resistor *No. 23* and *No. 24* burning)—check for "shorted" rectifier tube first
	2)	check field coil *No. 27*
	3)	"open" in output transformer *No. 21*
	4)	"open" winding in oscillator transformer *No. 6*
	5)	"open" voice coil *No. 22*
	6)	"open" voice coil ground connection
	7)	check i-f transformer *No. 11* for broken connection
	8)	"shorted" integral compensator condenser parts *No. 11B* and *No. 11C* of i-f transformer *No. 11*
Inoperative, Intermittent reception	1)	check for ground to chassis at secondary connection at bottom of antenna transformer *No. 1*
Inoperative on push-buttons (Model 39-7)	1)	broken connections or "open" switch contact
Inoperative on any one push-button (Model 39-7)	1) 2)	"shorted" antenna or oscillator padder "open" switch contact
Intermittently poor reception on push-buttons, Need for frequent retuning when on dial tuning (Model 39-7)	1)	faulty 20-mmfd. silvered mica condenser
Weak reception	1)	"open" primary or secondary in antenna transformer *No. 1*
	2)	check for broken-off lead from top contact of antenna transformer secondary to top connection at tuning condenser stator (usually occurs at tuning condenser end of lead from transformer)
Intermittent reception, Weak "tinny" signal	1)	check condensers *No. 14* and *No. 17*
Whistling or squealing	1) 2)	"open" condensers *No. 2* or *No. 10* "open" electrolytic condensers *No. 25* or *No. 26*
Hum (intermittent, or steady)	1)	"open" electrolytic condensers *No. 25* or *No. 26*

PHILCO 39-8

Inoperative	1)	"shorted" condenser *No. 9*
	2)	"open" ballast tube (indicated by no filament voltage anywhere)
	3)	"open" in output transformer *No. 22*
	4)	"open" voice coil, or "open" voice coil ground
	5)	"open" winding in oscillator transformer *No. 8*
	6)	check i-f transformer *No. 12* for broken connections
	7)	"shorted" integral compensating condenser parts *No. 12B* and *No. 12C* of i-f transformer *No. 12*
Inoperative, Weak, "tinny" signal	1)	check for ground to chassis at secondary connection at bottom of antenna transformer
Weak reception	1)	"open" condenser *No. 1*
	2)	"open" primary or secondary in antenna transformer *No. 4*—see Case History of Model 39-7
Intermittent reception, Weak, "tinny" signal	1)	"open" condensers *No. 16* and *No. 20*
Whistling or squealing	1) 2)	"open" condensers *No. 5* and *No. 9* "open" condensers *No. 24* and *No. 28*

PHILCO 39-17 (Codes 121 and 122)

Inoperative	1)	see *Note* (*P*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	see *Note* (*N*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories (indicated by resistors *No. 24* and *No. 25* burning)—check for "shorted" rectifier tube first
	3)	"shorted" condensers *No. 9* and *No. 21*
	4)	"open" field coil *No. 26*
	5)	"open" voice coil *No. 23*
	6)	"open" voice coil ground
	7)	"open" winding in oscillator transformer *No. 7*
	8)	check i-f transformer *No. 12* for broken connections
	9)	"shorted" integral compensating condenser parts *No. 12B* and *No. 12C* of i-f transformer *No. 12*
Inoperative, Weak, "tinny" signal	1)	check for ground to chassis at secondary connection at bottom of antenna transformer
Weak reception	1)	"open" primary or secondary in antenna transformer *No. 1*
	2)	check for broken-off lead from top of antenna transformer secondary to top contact of tuning condenser stator (usually occurs at tuning condenser end of the lead)
Intermittent reception, Weak, "tinny" signal	1)	"open" condensers *No. 15* and *No. 17*
Distortion, Weak, "tinny" signal	1)	check for high-resistance voice coil ground (may be intermittent)
Whistling or squealing	1) 2)	"open" electrolytic condenser *No. 28* "open" condensers *No. 2* and *No. 9*
Hum	1)	see *Note* (*N*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

PHILCO 39-18 (Codes 121 and 122)

Inoperative	1)	see *Note* (*P*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" ballast tube (indicated by no filament voltage anywhere)
	3)	"open" voice coil *No. 30*
	4)	"open" voice coil ground
	5)	check i-f transformer *No. 12* for broken connections
	6)	"shorted" integral compensating condenser parts *No. 12B* and *No. 12C* in i-f transformer *No. 12*
	7)	"open" winding in oscillator transformer *No. 9*
	8)	"shorted" condensers *No. 10* and *No. 25*
Inoperative, Weak, "tinny" signal	1)	check for ground to chassis at secondary connection at bottom of antenna transformer
Weak reception	1)	"open" condenser *No. 1*
	2)	"open" primary or secondary in antenna transformer *No. 2*
	3)	check for broken-off lead from top of antenna transformer secondary to top contact of tuning condenser stator (usually occurs at tuning condenser end of the lead)
Intermittent reception Weak "tinny" signal	1)	"open" condensers *No. 22* and *No. 20*
Distortion, Weak "tinny" signal	1)	check for high-resistance ground in voice coil (may be intermittent)
Whistling or squealing	1)	"open" condenser *No. 5* or *No. 10*
Push-button inoperative tuning	1)	check for loose shaft within manual tuning shaft (indicated by odd-shaped brass members of tuning mechanism slipping). Remove outer shaft of cone-centric tuning mechanism and tighten inner shaft so gang condenser turns when this shaft is rotated. Oil ball bearing of gang condenser—use light oil

PHILCO 39-19 (Codes 121 and 122)

Inoperative	1)	see *Note* (*P*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	see *Note* (*N*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories (indicated by resistors *No. 37* and *No. 38* burning)—check for "shorted" rectifier tube first
	3)	"open" voice coil *No. 34*
	4)	"open" voice coil (may be intermittent)
	5)	"shorted" section in electrolytic condenser *No. 31*
	6)	"shorted" condensers *No. 16* and *No. 32*
	7)	"open" winding in oscillator transformer *No. 6*
	8)	"open" field coil *No. 35*
	9)	check i-f transformer *No. 14* for broken connections
	10)	"shorted" integral compensator parts *No. 14B* and *No. 14C* in i-f transformer *No. 14*
Inoperative, Weak, "tinny" signal	1)	check for ground to chassis at secondary connection at bottom of antenna transformers *No. 1* and *No. 2*
	2)	"open" section in electrolytic condenser *No. 31*

(Cont'd)

PHILCO 39-19 (Codes 121 and 122)—*(Cont'd)*

Weak reception (on all bands)	1)	"open" primary in antenna transformer *No. 1*
	2)	check for broken-off lead from top contact of antenna transformer secondary to top connection at tuning condenser stator (usually occurs at tuning condenser end of lead from transformer)
Weak reception (on broadcast band only)	1)	"open" primary or secondary in antenna transformer *No. 2*
Intermittent reception, Weak reception	1)	"open" condensers *No. 24* and *No. 29*
Distortion, Weak, "tinny" signal	1)	check for high-resistance voice coil ground (may be intermittent)
Whistling or squealing	1)	"open" condensers *No. 8* and *No. 16*
	2)	"open" section in electrolytic condenser *No. 31* (may be intermittent)
Hum	1)	"open" section in electrolytic condenser *No. 31*
	2)	see *Note* (*N*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

PHILCO 39-25 (Code 121)

Inoperative	1)	see *Note* (*P*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	see *Note* (*N*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories (indicated by resistors *No. 42* and *No. 43* burning)—check for "shorted" rectifier tube first
	3)	"open" field coil *No. 40*
	4)	"shorted" condensers *No. 26* and *No. 13*
	5)	"open" primary in i-f transformer *No. 12* and *No. 20*
	6)	"open" winding in oscillator transformer *No. 6*
	7)	"shorted" integral compensating condenser parts *No. 20B* and *20C* in i-f transformer *No. 20*
	8)	"shorted" compensating condenser assembly *No. 5*
Inoperative on push-button tuning—O.K. on manual tuning	1)	inspect for broken lead between tuning condenser stator section and chassis
Inoperative on any push-button	1)	"open" condensers *No. 10* and *No. 11*
	2)	check for "loose" or high-resistance connection in push-button assembly and in coil assembly
Inoperative on any one push-button	1)	"open" corresponding oscillator coil
	2)	"shorted" corresponding antenna padder
	3)	check for "loose" or "floating" switch contacts
Inability to align push-buttons	1)	check condensers *No. 10* and *No. 11* for proper value (in some cases the wrong value was originally installed—correct value 370-mmfd. each)
Intermittent reception, Weak, "tinny" signal	1)	"open" condensers *No. 27* and *No. 30*

(Cont'd over)

PHILCO 39-25 (Code 121)—*(Cont'd)*

Weak reception on push-buttons (broadcast band)	1)	"open" secondary in antenna transformer *No. 2*
Distortion at low volume (lack of high notes)	1)	"shorted" condenser *No. 30*
	2)	check electrolytic condenser *No. 41* for a ground through its mounting
	3)	make sure that bass compensation condenser *No. 23* in the volume control circuit is connected in *series* between the 10,000-ohm resistor and ground (not in *parallel* with the resistor)
Distortion at high volume	1)	"shorted" condenser *No. 30*
Whistling or squealing	1)	"open" condensers *Nos. 3, 13* or *26*

PHILCO 39-30, 39-31, 39-35

(These models differ only as regards their cabinets, speakers and power transformers)

Inoperative	1)	see *Note* (*P*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	see *Note* (*N*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories (indicated by resistors *No. 45* and *No. 46* burning)—check for "shorted" rectifier tube first
	3)	"open" field coil *No. 44*
	4)	"shorted" condensers *No. 27* and *No. 13*
	5)	"open" primary in i-f transformer *No. 12* and *No. 20*
	6)	"open" winding in oscillator transformer *No. 6*
	7)	"shorted" integral compensating condenser parts *No. 20B* and *No. 20C* in i-f transformer *No. 20*
	8)	"shorted" compensating condenser assembly *No. 5*
Push-button troubles	1)	refer to Case Histories for these troubles listed under Philco 39-25 receiver
Intermittent reception, Weak, "tinny" signal	1)	"open" condensers *No. 30* and *No. 35*
Weak reception on push-buttons on broadcast	1)	"open" secondary in antenna transformer *No. 2*
Distortion at low volume	1)	"shorted" condenser *No. 35*
	2)	check electrolytic condenser *No. 43* for a ground through its mounting
Distortion at high volume	1)	"shorted" condenser *No. 35*
	2)	if tone is extremely high-pitched, try reversing the line plug. If this does not help, change position of the wires around volume control leads and grid lead to 75 tube
Whistling or squealing	1)	"open" condensers *Nos. 3, 13* and *27*
Whistling as volume control is advanced	1)	replace 250-mmfd. mica condenser *No. 34* by-passing 75 audio tube plate. Use a 0.01-mfd. replacement
Crackling, Noisy	1)	check 250-mfd. mica condenser *No. 34* by-passing 75 audio tube plate

PHILCO 39-36

Inoperative	1)	see *Note* (*P*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	see *Note* (*N*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories (indicated by resistors *No. 44* and *No. 45* burning)—check for shorted rectifier tube first
	3)	"open" field coil *No. 42*
	4)	"shorted" condenser *No. 13, 33* or *39*
	5)	"open" primary in i-f transformer *No. 12* or *No. 21*
	6)	"open" winding in oscillator transformer *No. 6*
	7)	"shorted" integral compensating condenser parts *No. 21B* or *No. 21C* in i-f transformer *No. 21*
	8)	"shorted" compensating condenser assembly *No. 5*
Push-button Troubles	1)	refer to Case Histories for these troubles listed under Philco 39-25 receiver
Intermittent reception, Weak, "tinny" signal	1)	"open" condensers *No. 30* and *No. 35*
	2)	check push-button switch assembly *No. 50* for "open" contact (indicated by noisy operation on push-buttons)
Weak reception on push-button or broadcast	1)	"open" secondary in antenna transformer *No. 2*
Distortion at low volume	1)	"shorted" condenser *No. 35*
	2)	check electrolytic condenser *No. 43* for a ground through its mounting
Distortion at high volume	1)	"shorted" condenser *No. 35*
Frequency drift (retuning receiver brings fading station back)	1)	check for "loose" dial disc hub
Whistling or squealing	1)	"open" condensers *Nos. 3, 13, 19* and *33*
Howling (due to audio oscillation)	1)	dress lead from output transformer *No. 40* to plate of 41 tube away from resistor *No. 31*
Hum	1)	high-resistance "leakage" between primary of power transformer and ground

PHILCO 39-40

Inoperative	1)	"shorted" condensers *Nos. 13, 19, 55* and *58*
	2)	"open" plate winding in oscillator transformer *No. 18*
	3)	"shorted" integral compensating condenser parts *No. 26C* and *No. 26D* in i-f transformer *No. 26*
Inoperative (over portion, or all, of broadcast band)	1)	"open" oscillator transformer *No. 16*
Weak reception (on all bands)	1)	"open" resonance circuit in i-f transformer *No. 23* (indicated by no "peak" when padded)
Weak reception (on broadcast band only)	1)	"open" in r-f transformer *No. 9*
Weak reception on push-button and broadcast	1)	"open" primary or secondary in antenna transformer *No. 1*

(Cont'd)

PHILCO 39-40—*(Cont'd)*

Weak reception on broadcast and short-wave	1)	"open" primary in r-f transformer *No. 11*
Intermittent reception, Weak, "tinny" signal	1)	"open" condenser *No. 31, 45, 48* or *52*
Intermittent reception (on push-buttons only)	1)	check push-button switch assembly *No. 71* for intermittent contacts (indicated by noisy operation)
	2)	check entire assembly for rosin joints and loose connections
Push-button Troubles	1)	see Case Histories listed for these troubles under Philco 39-25 receiver (Condensers *No. 74* and *No. 75* are the units concerned)
Noise, Hum	1)	check for "leakage" through the spaghetti insulation covering the lead of resistor *No. 51* to the *filament* or *K* prong of the 6J5G phase inverter tube
	2)	check for insulation "leakage" between all plate wires and points of zero or any negative potential in close proximity to the power transformer
Whistling or squealing	1)	"open" condensers *Nos. 13, 14, 19* and *42*
	2)	"open" resonance circuit in i-f transformer *No. 23* (indicated by motorboating sound)
	3)	poor grounding contact from low side of tertiary winding on 2nd i-f transf. *No. 23*. Remove transf. from chassis and disassemble from shield. Clean all impregnating wax from lug connected to top adjusting screw nut. Check all soldered connections carefully
No bass compensation	1)	"shorted" or "open" condensers *No. 48* and *No. 52*
Distortion	1)	"shorted" condenser *No. 45* and *No. 52*
Frequency drift (retuning receiver brings fading station back)	1)	check for "loose" dial disc hub

PHILCO 39-45 (Code 121)

Inoperative	1)	"shorted" condenser *No. 16, 26, 59* or *62*
	2)	"open" plate winding in oscillator transformer *No. 19*
	3)	"shorted" integral compensating condenser parts *No. 30C* and *No. 30D* in i-f transformer *No. 30*
Inoperative (over portion or all of broadcast band)	1)	"open" oscillator transformer *No. 17*
Intermittent reception, Weak, "tinny" signal	1)	"open" condenser *No. 36, 46, 54* or *58*
Intermittent reception (on push-buttons only)	1)	check push-button switch assembly *No. 79* for intermittent contact (indicated by noisy operation)
	2)	check entire assembly for rosin joints or loose connections
Weak reception (on all bands)	1)	"open" resonance circuit in i-f transformer *No. 27* (indicated by no "peak" when padded)

(Cont'd)

PHILCO 39-45 (Code 121)—*(Cont'd)*

Weak reception on push-button or broadcast band	1)	"open" primary or secondary in antenna transformer *No. 1*
Weak reception on police and broadcast bands	1)	"open" primary in r-f transformer *No. 10*
Weak reception (on short-wave bands only)	1)	"open" primary in r-f transformer *No. 13*
Weak reception (on police band only)	1)	"open" primary or secondary in antenna transformer *No. 2*
Push-button troubles	1)	refer to Case Histories covering these troubles listed under Philco 39-25 receiver (condensers *No. 77* and *No. 78* are the units concerned)
Noise, Hum	1)	same Case History as listed for this trouble under Philco 39-40 receiver
Whistling or squealing	1)	"open" condenser *No. 15, 16* or *26*
	2)	"open" resonance circuit in i-f transformer *No. 27* (indicated by motorboating sound)
No bass compensation	1)	"shorted" or "open" condenser *No. 54* or *No. 58*
Distortion	1)	"shorted" condenser *No. 46* or *No. 58*
Frequency drift (retuning receiver brings fading station back)	1)	check for "loose" dial disc hub

PHILCO 39-55

(With "Mystery" Wireless Remote Control)

All remote control operating difficulties	1)	see *Note (O)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Inoperative	1)	"open" resistor *No. 9*
	2)	"shorted" condenser *No. 12, 31, 33* or *36*
Inoperative on remote position only	1)	see *Note (O) item 7* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" condenser *No. 63* or *No. 62*
	3)	check entire assembly for rosin joints or loose connections
Inoperative (over portion or all of broadcast band)	1)	"open" oscillator transformer *No. 6*
	2)	"shorted" compensating condenser *No. 7*
Inoperative on any one station on "remote" position	1)	refer to push-button troubles of Philco 39-25 receiver (*No. 62* and *No. 63* are the condensers concerned)
Weak reception	1)	"open" primary or secondary in antenna transformer *No. 1*
	2)	"open" resonance circuit in i-f transformer *No. 13* or *No. 14* (indicated by no "peak" when padded)
Intermittent reception (remote position only)	1)	"open" condenser *No. 63* or *No. 62*
	2)	check for rosin joint or loose connection at oscillator coils bus line

(Cont'd over)

PHILCO 39-55—*(Cont'd)*

Mystery Control skips stations	1)	stepping relay armature hits pole piece before ratchet gear rotates sufficiently for holding latch to engage next tooth. Loosen two screws on top of stepper relay, and push armature fulcrum toward front of set just enough to cause proper operation. Tighten the two screws carefully
Distortion at resonance peak of station	1)	"open" resonance circuit in i-f transformer *No. 14* (indicated by no "peak" when padded)
No Bass Compensation	1)	"shorted" or "open" condenser *No. 30* or *No. 31*
Distortion	1)	"shorted" condenser *No. 30, 31, 33* or *36*
	2)	"partial open" resistor *No. 9*
Whistling or squealing	1)	"open" condenser *No. 2* or *No. 12*
	2)	"open" resonance circuit in i-f transformer *No. 13* or *No. 14* (indicated by no "peak" on padder, and motorboating sound)
Weak, "tinny" signal	1)	"partial open" resistor *No. 9*
Volume control motor inoperative	1)	"open" condenser *No. 59*
Frequency drift (retuning receiver brings fading station back)	1)	check for "loose" dial disc hub

PHILCO 39-70 (Code 121)

Audio howling and whistling	1)	dress *white* and *black* leads from output transformer to plate and screen of 1C5G tube as near as possible to the sub-base and away from tubular condenser *No. 3* and the *red* lead to the volume control

PHILCO 39-71, 39-72T

Inoperative	1)	"shorted" electrolytic condenser *No. 26* (indicated by overheating)
	2)	"open" winding in oscillator transformer *No. 8*
	3)	check i-f transformer *No. 12* for broken connections
	4)	"shorted" integral compensating condenser parts *No. 12B* and *No. 12C* in i-f transformer *No. 21*
	5)	"shorted" condenser *No. 10* or *No. 23*
Increasing sensitivity of early production Model 39-71 receivers (Run #1 Code 121)	1)	change 2-meg. resistor *No. 4* to a 4-meg. unit. Second i-f transformer *No. 12* should be changed to (Part *No. 32-3176*), and its 100-mmfd. trimmer *No. 12C* should be changed to a 110-mmfd. trimmer (Part *No. 30-1031*). 2-meg. resistor *No. 14* should be changed to a 10-meg. unit. Volume control and switch unit *No. 15* should be changed to a 1-meg. unit (Part *No. 33-5310*). Condenser *No. 16* (0.01-mfd.) should be changed to a 0.004-mfd. unit (Part *No. 30-4578*). Resistor *No. 17* (2-meg.) should be changed to a 4-meg. unit (Part *No. 33-540439*)
Microphonic	1)	try another 1H5G tube
Noise	1)	check "B" batteries for internal corrosion (by substitution)
	2)	"shorted" electrolytic condenser *No. 26* (indicated by excessive "B" current drain)

(Cont'd)

PHILCO 39-71, 39-72T—*(Cont'd)*

Howling and audio whistle	1)	dress plate leads to output tube away from coupling condenser *No. 20*—also away from condenser *No. 23*
Whistling and squealing	1)	tighten chassis contact of the shielding over *No. 1* i-f transformer
	2)	"open" condenser *No. 3* or *No. 10*
	3)	if control grid leads of 1H5G tube runs adjacent to dry battery leads, dress it down on *chassis* side of tube shield

PHILCO 39-116

(With "Mystery" Wireless Remote Control)

All remote control operating difficulties	1)	see *Note* (*O*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Inoperative	1)	"open" resistor *No. 30*
	2)	"open" plate winding in oscillator transformer *No. 21*
	3)	"shorted" condenser *No. 8, 11, 109, 62* or *66*
Inoperative on remote position only	1)	see *Note* (*O*) *item 7* listed under "Philco Receiver General Servicing Data" at beginning of Philco case hsitories
	2)	"open" condenser *No. 91* or *No. 92*
	3)	check entire assembly for rosin joints or loose connection
Inoperative over portion or all of broadcast band	1)	"open" oscillator transformer *No. 19*
	2)	"shorted" compensating condenser *No. 22* or *No. 23*
Inoperative on any one station on "remote" position	1)	refer to push-button troubles of Philco 39-25 receiver (*No. 91* and *No. 92* are the condensers concerned)
Inoperative on short-wave bands	1)	"shorted" condenser *No. 15*
Mystery Control skips stations	1)	stepping relay armature hits pole piece before ratchet gear rotates sufficiently for holding latch to engage next tooth. Loosen two screws on top of stepper relay, and push armature fulcrum toward front of set just enough to cause proper operation. Tighten the two screws carefully
Weak reception	1)	"open" resonance circuit in i-f transformer *No. 33* or *No. 38* (indicated by no "peak" when padded)
Weak reception on broadcast and remote	1)	"open" primary or secondary in antenna transformer *No. 1*
Weak reception on broadcast and police bands	1)	"open" primary in r-f transformer *No. 13*
Weak reception on short-wave bands	1)	"open" primary in r-f transformer *No. 14*
Intermittent reception, Weak, "tinny" signal	1)	"open" resistor *No. 30*
	2)	"open" condenser *No. 46, 50, 56* or *57*
Weak reception (only when using Mystery control)	1)	clean contacts on rotary arm of stepper relay
Whistling or squealing	1)	"open" condenser *No. 8, 5, 17, 11* or *34*
	2)	"open" resonance circuit in i-f transformer *No. 33* or *No. 38*

(Cont'd)

PHILCO 39-116—*(Cont'd)*

Noisy	1)	"open," "noisy," or changed value 6Q7 tube plate resistor
No Base Compensation	1)	"shorted" or "open" condenser *No. 56* or *No. 57*
Distortion	1)	"shorted" condenser *No. 50* or *No. 57*
Weak, "tinny" signal	1)	"partially open" resistor *No. 30*
Volume control motor inoperative	1)	"open" condenser *No. 88*
Frequency drift (retuning receiver brings fading station back)	1)	check for "loose" dial disc hub

PHILCO 39-117

(With exception that this receiver employs Electric Push-Button tuning, it is similar to Philco 39-17 receiver)

All receiver troubles	1)	see Case Histories listed for Philco 39-17 receiver
All push-button troubles	1)	see push-button trouble Case Histories listed for Philco 39-7 receiver

PHILCO 39-118

(With exception that this receiver employs Electric Push-Button tuning, it is similar to Philco 39-18 receiver)

All receiver troubles	1	see Case Histories listed for Philco 39-18 receiver
All push-button troubles	1)	see push button-trouble Case Histories listed for Philco 39-7 receiver

PHILCO 39-119

(With exception that this receiver employs Electric Push-Button tuning, it is similar to Philco 39-19 receiver)

All receiver troubles	1)	see Case Histories listed for Philco 39-19 receiver
All push-button troubles	1)	see push-button Case Histories listed for Philco 39-7 receiver

PHILCO 39-711

Regeneration at 15 to 22 mc	1)	add 250-mmfd. condenser (Part *No. 30-1119*) from suppressor grid of 6J8EG tube to ground

PHILCO 39-751

Unstable at 530 kc	1)	connect a 70,000-ohm resistor (Part *No. 33-370339*) in parallel with primary of r-f transformer *No. 16*

PHILCO 39-744 (Code 121)

Whistling or squealing in Run #1 receivers	1)	replace 15,000-ohm 1-watt resistor *No. 60* with a 20,000-ohm resistor (Part *No. 33-320339*). Add a 7,000-ohm resistor. (Part *No. 33-370339*) across primary winding of *No. 9* r-f transformer
To stabilize tuning of broadcast band and prevent regeneration	1)	remove condenser *No. 62* from the wiring panel, and connect them directly to screen terminal of 6S7G tube

PHILCO 40 D-C

Inoperative	1)	"open" speaker and tube socket contacts
	2)	"shorted" section in condenser *No. 12, 25* or *38*
	3)	"shorted" condenser *No. 17* or *No. 24*
	4)	"open" primary in input transformer *No. 33* and output transformer *No. 34*
	5)	"open" speaker voice coil
Intermittent reception	1)	"open" condenser *No. 31*—see *Note (A)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Weak reception (intermittently)	1)	"open" condenser *No. 10, 16* or *22*—see *Note (A)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 24*
	2)	"shorted" primary in input transformer *No. 33* and output transformer *No. 34* (indicated by "frying" noise)
Whistling or squealing	1)	"open" condenser *No. 12, 17* or *25*
Hum	1)	"open" section in condenser *No. 38*

PHILCO 40-81, 40-81T (Codes 121, 122)

Whistling or squealing	1)	feedback in 1A7 tube grid circuit. Wire from loop to 1A7 grid, wire from this grid to wiring panel, and wire from tuning condenser antenna circuit lug to wiring panel should all be kept as far away from 1A7 tube as possible. Redress these wires in this manner

PHILCO 40-100 (Codes 121 and 122)

Whistling or squealing at high volume	1)	due to coupling in audio leads. Try dressing them down close to chassis. If insufficient, try shifting position of 7C6 grid leads and output transformer leads
Volume control and switch work "hard"	1)	file down corner of plate on control shaft where it engages fibre roller at other end of flag

PHILCO 40-110

Push-button fails to tune receiver	1)	check for faulty 370-mmfd. condenser across inoperative push-button. Replace condenser

PHILCO 40-115, 40-124 (Code 121)

Inoperative, Hum when volume control is at "loud" position	1)	volume control arm "shorting" to shaft. Replace volume control
Intermittent reception and hum	1)	"short" between primary and secondary leads of first i-f transformer
Whistling or squealing	1)	"open" 0.05-mfd. by-pass condenser connected to screen of 7B7 i-f tube

PHILCO 40-125

Whistling or squealing	1)	connect a 0.01-mfd. condenser from center pin of 7B7 i-f tube to chassis
Speaker rattle	1)	if voice coil is centered O.K., remove felt around rim and check for loose cone rim. Cement any loose portion firmly in place

PHILCO 40-130, 40-135

Whistling or squealing at low-frequency end of broadcast band	1)	replace second i-f transformer *No. 21* (Part *No. 32-3281*) with new type transformer (Part *No. 32-3382*)

(Cont'd over)

PHILCO 40-130, 40-135—*(Cont'd)*

Audio howling or whistling	1)	caused by audio feedback from tone control condensers and their leads to the leads of the volume control. Separate these leads as much as possible from the volume control leads

PHILCO 40-140, 40-145

Audio howling or whistling	1)	caused by audio feedback from tone control condensers and their leads to the leads of the volume control. Separate these leads as much as possible from the volume control leads

PHILCO 40-150

Weak reception, Distortion	1)	"leaky" 0.01-mfd. screen by-pass condenser on 41 push-pull output tubes
Hum	1)	connect a 10-mfd. condenser across *No. 59* and *No. 60* bias resistors
	2)	wires connected from bottom lugs of osc. transf. *No. 18* to waveband switch should be pushed toward the push-button switch. The wires connecting the loop panel to the wave switch must be clear of oscillator transformer *No. 18*

PHILCO 40-155

Weak reception	1)	wires connected from bottom lugs of osc. transf. *No. 18* to waveband switch should be pushed toward the push-button switch. The wires connecting the loop panel to the wave switch must be clear of oscillator transformer *No. 18*

PHILCO 40-160

Whistling or squealing	1)	remove the 6,800-ohm resistor shunted across the primary of the r-f transformer and connect it across the secondary winding
Audio howling or whistling	1)	caused by feedback from tone control condensers and their leads to the leads of the volume control. Separate these leads as much as possible from the volume control leads

PHILCO 40-165

Audio howling or whistling	1)	caused by feedback from tone control condensers and their leads to the leads of the volume control. Separate these leads as much as possible from the volume control leads
Hum	1)	add another 0.05-mfd. condenser in parallel with speaker field coil

PHILCO 40-170CS

Whistling or squealing at low-frequency end of broadcast band	1)	replace second i-f transformer *No. 21* (Part *No. 32-3281*) with new type transformer (Part *No. 32-3382*)

PHILCO 40-180, 40-185

Inoperative	1)	if resistors *No. 59* and *No. 60* in negative-return circuit are overheated or damaged, check for "shorted" 84 tube
Inoperative (on broadcast band only)	1)	"shorted" high or low-frequency padder

(Cont'd)

PHILCO 40-180, 40-185—*(Cont'd)*

Weak reception	1)	wires connected from bottom lugs of osc. transf. *No. 18* to waveband switch should be pushed toward the push-button switch. The wires connecting the loop panel to the wave switch must be clear of oscillator transformer *No. 18*
Push-button frequency settings drift	1)	replace 370-mmfd. silvered mica condensers on each side of oscillator coil

PHILCO 40-190

Inoperative	1)	if resistor *No. 59* or *No. 60* in negative-return circuit are overheated or damaged, check for "shorted" 84 tube

PHILCO 40-195, 40-200

Intermittent reception	1)	suppressor winding of first i-f transformer is grounded through a threaded bushing and screw to the shield can, which in turn is grounded to the sub-base. The resistance between the bushing and the screw varies due to wax, dirt, etc., and in some cases the connection is "open" entirely between the threaded bushing and the ground lug. Ground completely with flexible braid
Weak reception in Model 40-195	1)	connect a 27-ohm resistor (Part *No. 33-027339*) in series with the oscillator grid circuit of all receivers using the 6J8G tube
To improve padding of circuit in Police Band	1)	add a mica condenser (Part *No. 61-0038*) across the Police Band Oscillator Padder *No. 25A*

PHILCO 40-525 (Code 121)

Whistling or squealing	1)	isolate cathode connection of 7C7 r-f tube from "common" connection of other tubes, and connect it directly to chassis

PHILCO 40-748 (Code 121)

Weak reception on low-frequency end of short-wave band	1)	replace 47,000-ohm resistor *No. 33* in oscillator circuit with a 100,000-ohm unit

PHILCO 41 D.C.

Inoperative	1)	"shorted" condenser *No. 18* or *No. 32*
	2)	"open" primary in input transformer *No. 30*
	3)	"open" speaker and tube socket contacts
Intermittent reception	1)	"open" condenser *No. 27*—see *Note (A)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	faulty 0.05-mfd. condenser connected from "ground" binding post to chassis
Weak reception (often intermittently)	1)	"open" condenser *No. 6, 12,* or *16*—see *Note (A)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Fading to a very low volume which can be restored to normal value by turning the volume control	1)	defective by-pass condenser across 5,000-ohm resistor in the detector grid-return circuit. Replace with a new unit

(Cont'd)

PHILCO 41 D.C.—*(Cont'd)*

Fading	1)	defective first r-f tube (even though it may test O.K.). Replace with new tube
	2)	defective antenna coil. Replace
Choppy reception, Distortion	1)	replace the 0.5-megohm resistor in grid circuit of 1st audio stage. Use a lower value of resistance—around 100,000-ohms. Also connect a 3,000-ohm current-limiting resistor in series with the primary winding of the push-pull input transformer
	2)	faulty input transformer. Replace
Distortion at low volume	1)	interchange detector tube with an r-f tube
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" input transformer *No. 30* (indicated by "frying" noise)
	2)	"shorted" condenser *No. 21*
Hum	1)	connect a 1 or 2-mfd. condenser from the detector screen grid to chassis
	2)	"open" section in condenser *No. 32*
Whistling or squealing	1)	"open" condenser *No. 9, 22* or *No. 32*

PHILCO 41KR

Carrier-modulated hum	1)	inspect all wires of built-in loop for a possible "break"—especially under each staple which fastens loop to cabinet

PHILCO 41-85

How to increase sensitivity of receiver	1)	remove 0.05-mfd. condenser located between low side of the volume control and *No. 1* pin of 1LH4 tube If additional sensitivity is required, the following change is recommended: It will be necessary to add a 2.2-meg. resistor between B-plus and *No. 3* prong. An 0.05-mfd. condenser is connected between the above prong and the "low" side of the volume control. It would be well to try several 1LD5 tubes and select that which gives the least microphonics. After these changes are made, a realignment of the i-f amplifier is recommended

PHILCO 41-90

Squealing	1)	replace volume control

PHILCO 41-100

Weak reception, Poor tone at med. and high volume	1)	"open" output transformer. Replace

PHILCO 41-240

Intermittent reception	1)	caused by intermittent operation of oscillator caused by dirt and dust collected between plates of oscillator tuning condenser. Clean out

PHILCO 41-285

Rumbling noises	1)	check 1st i-f transformer for faulty connections. Resolder
	2)	resolder both ends of small mica condenser located in shield with the i-f transformer
Push-buttons do not hold their station adjustment	1)	replace 370-mmfd. dual condenser attached to gang switch with new improved type silver mica units

PHILCO 41-608 Automatic Record Changer

Jamming	1)	bent cam connecting rod lift DK. If bent, this rod will jam against gear DC. To adjust, remove, reshape and reassemble. This rod can also become jammed if lift spring is missing or if shoulder screw DL is loose
Jammed or frozen changer shaft	1)	dismantle, sandpaper, clean and oil shaft
"Wow" (erratic varying turntable speed)	1)	check through all phono records, and discard or replace any that are warped
	2)	replace motor coupling assembly if damaged
Idler gear assembly binds	1)	dismantle, clean and oil bearings, grease gears
Turntable spindle not lined up with motor spindle	1)	loosen screws holding mounting plate, align spindles and retighten screws on mounting plate
Mounting plate bent	1)	to adjust, dismantle, straighten and reinstall
Motor speed erratic	1)	may be due to poor lubrication. Set-screw for adjusting play in armature may have been inserted too far, binding armature. Reset play in armature
Erratic tone arm landing	1)	loose tone arm—tone arm not properly set on hinge spring CD. Reset tone arm on hinge spring
	2)	bent tongue on clutch assembly CQ. Use pressure to straighten. Binding adjusting rod assembly—there is a hook on the end of this rod, which is actuated by the side of left lever DK. This hook goes through a slot in the sub-panel. When this hook is bent, erratic tone arm landing will result. To adjust, straighten hook
	3)	weak tension on springs. Check for tension on all springs including those shown in illustration—CN, CO, CP, and tension spring on adjusting rod assembly. Adjust tension on springs by removing one or two turns. If there is not enough tension on springs after taking one or two turns off, replace springs
	4)	binding swivel tube and trunnion assembly CK. There are three 1/16" ball bearings on top of this tube and trunnion assembly. If ball bearings are missing, binding will result. If missing, install new ones
	5.	if trunnion binds in swivel post, apply oil. If oiling is ineffective, dismantle and clean trunnion and swivel post
	6)	guide arm CJ fails to release from cam gear at end of cycle. The tone arm will be "knocked off record" when this occurs. To adjust, increase tension on guide arm spring CN. Check for binding guide arm at trunnion shoulder screws CL. Binding may be due to bent or rough shoulders. Straighten, sandpaper, clean and oil shoulders
Erratic tripping	1)	incorrect clearance between trigger DO and clutch CR If clearance is too small, tripping will be continuous. If clearance is too great, tripping will not result. To adjust clearance, reset clutch screw DP
	2)	reset clutch play. When there is no clutch play, panel will trip continually. To adjust reset set-screws on clutch release assembly
Howling, Mechanical vibration	1)	check to see that shipping bolts on both chassis and motor have been loosened
	2)	replace lamp in tone arm (unless this lamp has a very rigid filament, mechanical vibration will cause it to vibrate and the variation in its light will be transferred to the amplifier and reproducer)
	3)	if necessary, dampen vibration by cementing pieces of soft felt or rubber in tone arm back of tone head

PHILCO 41-611

(Automatic Record Changer with photo-electric cell unit)

Wavering or rumbling reproduction	1)	loose mirror on crystal assembly
	2)	loose filament in pilot light
	3)	excessive vibration due to motor mounting, or to panel being mounted to cabinet too tightly

PHILCO 41-621, 41-624, 41-625, 41-629

Inoperative on phono	1)	check to see if light beam is completely on, or completely off, the photo-electric cell. If this condition exists, make the following adjustments with the line voltage at 118 volts A-C **(A) Adjusting Width of Light Beam** To make this adjustment, push the lamp socket assembly into its holder until a clear image of the lamp filament appears on the light cell. The socket should then be slightly pushed in beyond this point until the rectangular spot of light is 5/32" in width. The socket assembly is now rotated so that the spot of light is *vertical* **(B) Positioning the Light Beam** To position the light beam on the light cell, turn the adjusting screw at the lower left side of the reproducer until the spot is half on the cell and half on the metal frame surrounding the cell
Weak, distorted on phono	1)	light beam out of adjustment. Readjust as directed immediately above

PHILCO 42 D. C.

Same Case Histories as those listed for Philco 41 D-C receiver

PHILCO 42-122 (Code 121)

Audio howl	1)	replace 10,000-ohm resistor *No. 26* with a 4,700-ohm unit

PHILCO 42-126 (Code 121)

Improving power output	1)	replace 800-ohm resistor *No. 52* with a 680-ohm unit

PHILCO 42-350 (Code 121)

Oscillation	1)	remove ground lead of condenser *No. 30* from contact *No. 4* of 7V7 first i-f tube socket and connect it to contact *No. 8* of same socket
"Flutter" on FM	1)	improve filtering in rectifier circuit by replacing the 4-mfd. 400-volt electrolytic condenser *No. 40* across the rectifier with a 12-mfd. unit

PHILCO 42-395 (Code 121)

To improve filtering of i-f plate voltage supply	1)	change condenser No. 47 to 0.05-mfd. unit

PHILCO 42-842, 42-843, 42-844, 42-853, 42-854

Tubes have short life	1)	replace 1800-ohm series filament resistor (shown as *No. 49* in Philco Service Bulletin 391, and as *No. 56* in Philco Service Bulletin 388) with a 10-watt wire-wound unit. Mount new unit vertically over one of original holes in chassis

PHILCO 42-1004 (Code 121)

To improve operating performance of rectifier circuit of chassis marked *"Run 1"*	1)	change wiring of rectifier tube 50Y6GT socket as follows: Remove the base wire between contacts *2* and *3*. Connect a wire from contact *3* of the socket to the lug of the filament resistor *No. 43* to which condenser *No. 40* is already attached. This change was incorporated in all chassis marked *Run 2*

(Cont'd)

PHILCO 42-1004 (Code 121)—*(Cont'd)*

To improve tone quality of phono reproduction in *"Run 1"* and *"Run 2"* chassis	1)	change 0.01-mfd. condenser *No. 36* to a 0.006-mfd. 400-volt unit

PHILCO 42-1010

Rumble on phono reproduction	1)	replace turntable bearing. Remove turntable and spindle and then take out the brass cone and the ball bearings and washers. Rebuild bearing, using the old washers and the new flat fibre washer and the concave steel washer. Add "Stay-Put Grease," or "Lubriplate" between the washers to eliminate friction. When replacing spindle assembly, spindle must be more than ½ turn loose while lining it up with the record support shelf
"Flutter" and change of speed	1)	caused by friction in the vertical drive assembly, and by action of the regeneration spring (item *21* in Philco Service Bulletin No. 402). The folowing changes involving the regeneration spring and the vertical drive assembly should be made on every changer on which there is an opportunity to do so: (*a*) remove the regeneration spring and the threaded adjusting screw and nuts (*b*) loosen the two bell drive disc bearing screws on the bottom of the motor mounting bracket (*c*) push the motor drive disc and armature to the extreme right, against the thrust spring. Allow 1/8" clearance between the rim of the bell drive disc and the motor drive disc and tighten the two bearing screws securely (*d*) the change consists of removing the cupped washer and the flat washer below the upper bearing plate and adding two fiber washers, one on each side of the steel washers above the oilless bearing. The collar should be reset allowing approximately ⅛" clearance between the collar and the upper bearing support. The oilless bearing should seat in the upper bearing support and should not turn with the vertical shaft (*e*) there is a small fiber washer which is used to limit the motion of the upper bearing support assembly. Loosen the screw holding this eccentric washer. Hold the vertical drive shaft at approximately 3° to the right of perpendicular and adjust the washer and fasten in place
Noise when phono motor runs	1)	see if *steel* sleeve is used on motor shaft to prevent armature from slipping out of line. If so, cement this sleeve to the end of armature with speaker cement
Tone arm drops	1)	incorrect dress of leads back of the tone arm. They should be dressed toward the turntable spindle at the end of the tone arm
	2)	incorrect lubricant used on tone arm spindle, causing it to stick. Use only a 20 SAE grade oil mixed with ⅛ special Shaler Rislone oil for lubricating it

(Cont'd)

PHILCO 42-1010—*(Cont'd)*

"Wow," Distortion — 1) tone arm is not free. Any binding in either direction will cause the light beam to pull off the cell and produce wow and distortion. The drag should not exceed ⅛ ounce

Flutter, Mistracking, Distortion — 1) stiff mirror and jewel assembly. Check the flexibility of this assembly. With the record changer stopped, put a record on the turntable and place the tone arm on the record. Open the peep hole in the pick-up cover—the light beam should be $\frac{5}{32}$" wide and should be half "on" and half "off" the photo-electric cell. Hook the Philco Scale, *Part No. 45-2851*, under the cover at the nose and pull laterally, first toward the spindle and then away from the spindle. The jewel assembly should be sufficiently flexible to allow the light beam to be pulled completely off the cell and completely on the cell with less than 1 ounce of lateral pull—from ½ ounce to ¾ ounce is the most desirable. Replace the mirror and jewel assembly if more than 1 ounce pull is required

PHILCO 42-1011 (Code 121)

Same Case History as listed for Philco 42-1019 (Code 121) receiver

PHILCO 42-1012, 42-1013 (Code 121)

Loop aerial repairs — 1) if the loop aerial (broadcast and short-wave) is removed from the cabinet for replacement or repairs, it should be remounted with the side of the loop having the *red*, or *red-and-white*, lead toward the rear of the cabinet. This is necessary to increase the stability at the low-frequency end of the broadcast band, and to reduce whistles

PHILCO 42-1015 (Code 121)

Hum (in chassis marked *"Run 1"*) — 1) add a filter circuit to the 6L6G output tubes, consisting of a 0.1-mfd. 200-volt condenser and a 100,000-ohm resistor

PHILCO 42-1016

Same Case History as listed for Philco 42-1010 receiver

PHILCO 42-1019 (Code 121)

Hum (in chassis marked *"Run 1,"* *"Run 2,"* or *"Run 3"*) — 1) change 9-9-mfd. 475-volt electrolytic condenser *No. 32-32A* to 8-24 mfd. 475 volts. The 8-mfd. section is connected in the circuit position (*No. 32*), and the 24-mfd. section in position (*No. 32A*) across the rectifier output

2) remove the 0.01-mfd. condenser, which is connected from the center tap of the volume control to the terminal on the wiring panel right below it. Also, remove the 10-meg resistor which is wired to this terminal and to the second terminal of the bias resistor *No. 82*

Remove the wire which formerly connected the resistor and condenser to the *No. 3* terminal of the 7C6 tube socket. Connect the center terminal of the volume control to the dummy *No. 4* terminal of the 7A4 tube socket. Connect the second terminal of the resistor *No. 82* to the dummy *No. 3* terminal of the 7A4 tube socket. Both of these leads must be dressed close to the chassis sub base Connect the 0.01-mfd. condenser from the *No. 3* terminal of the 7C6 tube to the *No. 4* terminal of the 7A4 tube. Connect the 10-meg resistor from the *No. 3* terminal of the 7C6 tube to the *No. 3* terminal of the 7A4 tube

(Cont'd)

PHILCO 42-1019 (Code 121)—*(Cont'd)*

Oscillation (in chassis marked *"Run 1,"* or *"Run 2"*) — 1) connect a 0.2-mfd. 400-volt condenser in the circuit at the lug of the terminal panel where resistors *No. 33*, *No. 39* and *No. 44* are connected. Ground one side of the condenser

To improve oscillation performance (in chassis marked *"Run 1"* to *"Run 4"*) — 1) change 375-mmfd. mica condenser *No. 16* to 350-mmfd. unit

PHILCO 43 A-C

Inoperative — 1) "shorted" condenser *No. 44*, *46*, *47* or *65*

Intermittent reception — 1) "open" condenser *No. 55* or *No. 61*—see *Note* (*A*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

Distortion at low volume — 1) "shorted" condenser *No. 61*

Distortion at high volume, Weak, "tinny" signal — 1) "shorted" condenser *No. 44* or *No. 65*

Whistling or squealing — 1) the resistor to the plate of *No. 1* i-f tube may have been incorrectly connected at the factory by wiring a condenser to wrong side of resistor and condenser *No. 46*. The lead from condenser block *No. 44* should be connected to the lug of the bakelite-encased condenser to which the i-f transformer lead is connected

2) "open" condenser *No. 44* or *No. 46*

PHILCO 44

Inoperative — 1) "shorted" section in condenser *No. 67* (indicated by overheated rectifier tube)

2) "shorted" section in condenser *No. 25* or *No. 65*

3) "shorted" condenser *No. 59*

4) "open" primary in output transformer *No. 62*

Intermittent reception — 1) "open" condenser *No. 48* or *No. 55*—see *Note* (*A*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

2) "open" in i-f transformer *No. 28*, *34* or *39*—see *Note* (*B*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

Inoperative, Weak reception — 1) check floating contacts on frequency switch. These contacts may drop out completely, or slip into adjoining position if the fixed segment is loose or bent. This is indicated by the presence of short-wave signals on broadcast band setting, or the inability of the oscillator to track properly

2) open-circuited type '75 tube grid-coupling condenser

3) short-circuited or leaky condenser connected from junction of two 70,000-ohm resistors in plate circuit of type '75 tube to ground

(Cont'd over)

PHILCO 44—*(Cont'd)*

Volume increases, Selectivity poor on broadcast band	1)	due to improper setting of waveband switch. Moving contact of third section of switch engages second wiping contact before disengaging the first one
Weak on short-waves, Station hiss	1)	open-circuited 0.00025-mfd. postage-stamp type condenser connected between two bottom contacts of 3rd and 4th switch sections
Distortion, Type '42 screen red hot	1)	insulation of electrolytic condenser leaky, or can shorting to chassis
Distortion at resonance peak of station	1)	"partial open" resistor *No. 58*
	2)	check for high-resistance leakage in third i-f coil. Replace
Distortion at low volume	1)	"shorted" condenser *No. 48*
Distortion at high volume, Weak, "tinny" signals	1)	"shorted" section in condenser *No. 65*
	2)	"shorted" condenser *No. 48* or *No. 59*
Hum	1)	"open" section in condenser *No. 67*
Whistling or squealing	1)	"open" condenser *No. 25*
	2)	"open" condensers *No. 6* and *No. 44* — see *Note (A)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Balancing	1)	if unable to make broadcast band track properly, recheck short-wave adjustments (especially high band)—make sure short-wave is balanced on "fundamental" and not on "image" signal
Eliminating code interference	1)	readjust the wave trap for minimum-interference

PHILCO 45

See also Case Histories listed for Philco 29 receiver

Inoperative, or Distortion	1)	if tubes check O.K., replace by-pass condenser *No. 30-4170M* with a 0.05-mfd. 600-volt unit
	2)	"shorted" section in condenser *No. 62* (indicated by overheating of rectifier tube)
	3)	"shorted" condenser *No. 17, 22, 31* or *41*
	4)	"open" choke *No. 59* (sometimes indicated by "frying" noise—also grounded occasionally)
Inoperative (no plate voltage on 75 tube)	1)	defective 0.1-mfd. plate condenser. Replace with new unit of higher voltage rating
Intermittent reception (especially when tuning)	1)	bolts holding tuning condenser to chassis too long or too tight, thereby short-circuiting to the stator section. Repair by loosening the bolts or cutting ends off
Intermittent reception	1)	"open" i-f transformer *No. 18, 23* or *28* —see *Note (B)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	check volume control
	3)	if receiver operates intermittently at first and later cuts out, replace bakelite-encased condenser block (Part *No. 4989Z*) containing two 0.09-mfd. condensers. Replace with two 0.1-mfd. 600-volt tubular paper condensers

(Cont'd)

PHILCO 45—*(Cont'd)*

Weak reception	1)	short-circuited terminals on dual section, 8-mfd. electrolytic condenser
	2)	short-circuited turns in i-f transformer secondary. Replace with new unit
	3)	replace 500-ohm cathode resistor for the 6A7 tube with a 350 or 400-ohm unit
	4)	rebalance the receiver circuits
Low volume during warm-up period, then increases	1)	replace wave-trap with improved part No. 39-5995
Weak reception or intermittent reception over portion of band	1)	replace resistor *No. 8* with a 300-ohm unit
	2)	replace resistor *No. 21* with a 400-ohm unit
	3)	replace resistor *No. 10* with a 45,000-ohm unit
	4)	replace condenser *No. 13* with a 0.00025-mfd. unit
Distortion at high volume, Weak, "tinny" signal	1)	try 6A7 tube (even though it checks O.K.)
	2)	"shorted" condenser *No. 41*
	3)	"shorted" condenser *No. 39*
Hum	1)	"open" section in condenser *No. 62*
Motorboating sound	1)	intermittent "open" in dual 0.09-mfd. condenser *No. 22*. Replace
Loud buzzing sound from chassis	1)	loose power transformer laminations. Tighten them
Whistling at resonance point, Extremely sharp tuning	1)	replace first i-f tube cathode resistor with 500-ohm unit
	2)	check 0.9-0.9 mfd. dual condenser No. 22 which shunts grid bias resistor for the 39 and 44 i-f tubes and also used as a by-pass for the screen-grid tubes
	3)	carefully adjust trimmers on first i-f stage to resonance
Whistling or squealing all over dial	1)	if accompanied by motorboating sound, check condenser *No. 22*
	2)	"open" condenser *No. 5*
Continual failure of '80 tube	1)	replace the entire filter *No. 33-2028* with new replacement Part *No. 30-2079*

PHILCO PT45 Transitone

Inoperative	1)	if pilot light flickers, bend plate contact of 35A5 tube socket so it makes better contact

PHILCO 46 D-C

Inoperative	1)	"shorted" section in condenser *No. 34*
	2)	"shorted" condenser *No. 7, 12, 18,* or *23*
	3)	"shorted" section in condenser *No. 34* (indicated by chokes *No. 41* and *No. 42* overheating)
	4)	"open" primary in input transformer *No. 26* and output transformer *No. 31*
	5)	"open" choke *No. 41* or *No. 42* (sometimes indicated by "frying" noise)
Intermittent reception	1)	"open" condenser *No. 21*—see *Note (A)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" primary in input transformer *No. 26* and output transformer *No. 31* (indicated by "frying" noise)
	2)	"shorted" condenser *No. 23*
Hum	1)	"open" section in condenser *No. 34*

(Cont'd)

PHILCO 46 D-C—*(Cont'd)*

Whistling or squealing	1)	clean "grounds" to tuning condenser rotors
	2)	"open" condenser *No. 7, 5, 12, 18* or *34* —see *Note (A)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Replacing '14 and '17 tubes with others more easily obtainable	1)	include 75-ohm 10-watt resistor in series with speaker field. Use 39's in the r-f stages, '36 in the detector, and '37 in the audio

PHILCO 47 D-C

Inoperative	1)	"shorted" section in condenser *No. 38* (indicated by choke *No. 48* overheating)
	2)	"open" choke *No. 44* or *No. 48* (sometimes indicated by "frying" noise)
	3)	"open" primary in input transformer *No. 46*
Inoperative over high-frequency end of band	1)	check oscillator transformer *No. 17* for dampness. Replace
	2)	check i-f transformer *No. 23* for dampness. Replace
	3)	replace type *No. 36* tube
Intermittent reception	1)	check *No. 44* and *No. 36* tubes for "short" from filament to cathode
	2)	"open" condenser *No. 35* or *No. 41* — see *Note (A)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	3)	check audio coupling condenser
	4)	check pilot light socket behind tuning meter for "short" to chassis
Distortion at low volume	1)	"shorted" condenser *No. 41*
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" primary in input transformer *No. 46* (indicated by "frying" noise)
	2)	"shorted" section in condenser *No. 38*
Whistling or squealing	1)	"open" condenser *No. 5, 7,* or *9*
Hum	1)	"open" section in condenser *No. 38*
	2)	"open" condenser *No. 8*
Pilot lamp burns out when set is first turned on	1)	remove resistor *No. 39*. Remove the wire from the cathode circuits of both output tubes from its connection at the filament of the *No. 2* audio frequency tube socket, and connect it to the opposite filament terminal at the same socket. Disconnect the wires connected to the pilot light sockets, and connect them together. Then connect the pilot lamp across the filament of the first a-f tube socket; if shadow tuning meter is used connect its pilot lamp across the filament of the second a-f tube socket

PHILCO 48 D-C

Inoperative	1)	"open" shoke *No. 46* (sometimes indicated by "frying" noise)
	2)	"shorted" section in condenser *No. 28*
	3)	"shorted" condenser *No. 43*
	4)	"shorted" condenser *No. 44* (indicated by choke *No. 46* overheating)
	5)	"shorted" condenser *No. 28* (indicated by overheating of field coil)
	6)	"inter-winding short" in i-f transformer *No. 22* or *No. 24*—see *Note (C)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

(Cont'd)

PHILCO 48 D-C—*(Cont'd)*

Inoperative over high-frequency portion of band	1)	improper adjustment of high-frequency condenser. Readjust it and seal with sealing wax so it will stay adjusted
	2)	replace oscillator transformer *No. 13* if damp
	3)	replace detector oscillator type *No. 36* tube
Intermittent reception	1)	"open" condenser *No. 38* or *No. 1*—see *Note (A)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Distortion at low volume	1)	"shorted" condenser *No. 38*
	2)	check both '36 tubes by substitution
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" section in condenser *No. 28*
	2)	"shorted" condenser *No. 43*
	3)	"open" choke *No. 46* (indicated by "frying" noise)
Whistling or squealing	1)	clean "grounds" to tuning condenser rotors
	2)	"open" condenser *No. 3, 10* or *21*
	3)	"open" section in condenser *No. 28*
Hum	1)	"open" section in condenser *No. 4*
	2)	"open" section in condenser *No. 28*
	3)	"open" condenser *No. 3*

PHILCO 49 D-C

Inoperative	1)	"shorted" section in condenser *No. 64* (indicated by choke *No. 59* overheating)
	2)	"shorted" section in condenser *No. 63* (indicated by choke *No. 58* overheating)
	3)	"shorted" section in condenser *No. 39* (indicated by resistor *No. 60* overheating)
	4)	"shorted" condenser *No. 41* (indicated by *wide* tuning meter shadow)
	5)	"open" primary in input transformer *No. 51*
	6)	"shorted" condenser *No. 19* (indicated by *positive* voltage on oscillator control grid)
Intermittent reception	1)	"open" condenser *No. 36* or *No. 44* — see *Note (A)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" in i-f transformer *No. 22* or *No. 27*—see *Note (B)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Distortion at low volume	1)	"shorted" condenser *No. 44*
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" section in condenser *No. 39*
	2)	"shorted" primary in input transformer *No. 51* (indicated by "frying" noise)
Whistling or squealing	1)	"open" condenser *No. 66*
	2)	"open" section in condenser *No. 39, 63* or *64*
	3)	"open" condenser *No. 7, 9* or *25*
Hum	1)	"open" section in condenser *No. 63* or *No. 64*

PHILCO 50, 50-A

Inoperative	1)	"shorted" condensers *No. 16* and *No. 24*
	2)	"shorted" section in condenser *No. 25*
Inoperative (only a hum heard)	1)	check for "grounded" avc circuit

(Cont'd over)

PHILCO 50, 50-A—*(Cont'd)*

Inoperative accompanied by sizzling and flashing in the chassis	1) 2)	badly carbonized rectifier socket faulty tone control—replace
Intermittent reception	1)	"open" condenser *No. 12*—see *Note* (*A*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Low volume, Distortion, Whistling "Hiss" (only after a tube has been replaced)	1)	connect a 0.5-mfd. condenser from the movable arm of the volume control to ground
Weak reception	1)	defective volume control resistor. Replace with new unit
Distortion at low volume	1) 2)	"shorted" condenser *No. 12* interchange detector with an r-f tube
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 16* or *No. 15*
Harsh tone	1)	replace stiff speaker cone
Hum	1)	"open" section in condenser *No. 15*
Whistling or squealing	1) 2) 3)	clean "grounds" on tuning condenser rotors "open" condenser *No. 22* "open" section in condenser *No. 15*
Noisy, and whistling or squealing at low-frequency end of dial	1)	ground the loudspeaker frame

PHILCO 51, 51-A, 52

Inoperative	1) 2)	"inter-winding short" in i-f transformer *No. 12* or *No. 16*—see *Note* (*C*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories "shorted" condensers *No. 14*, *23* and *28*
Inoperative from 550 to 1,100 kc, Intermittent reception	1) 2) 3) 4)	replace the 710-mmfd. i-f compensating shunt condenser. It is part of No. 5863. Remove the compensating condenser to the right of the power transformer (looking into the chassis with tuning dial to your left) and you will find the 710-mmfd. unit on its underside rotor plates of oscillator tuning condensers touch stator plates—possibly at the low-frequency position. Place an insulated wire, or fibre, around the spacer of the rotor plates check det.-osc. tube by substitution inspect oscillator transformer *No. 8* for dampness. Replace
Intermittent reception	1) 2)	"open" condenser *No. 26*—see *Note* (*A*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories if elements of 47 tube are overheated, replace it
Distortion and Blasting (everything checks O.K.) (in Model 52 receiver only)	1)	too much bias on the 47 tube. Between the negative of the large filter condenser which is insulated from the chassis and grid resistor of the 47 audio tube, there is a *yellow*-and-*black* resistor (490,000 ohms). Replace this resistor with one of 200,000 or 250,000 ohms

(Cont'd)

PHILCO 51, 51-A, 52—*(Cont'd)*

Distortion at low volume	1) 2) 3)	"shorted" condenser *No. 26* check type *No. 35* tube for proper location interchange *No. 1* and *No. 2* detector tubes
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 23* or *No. 28*
Harsh tone	1)	replace stiff speaker cone
Whistling or squealing	1) 2)	clean "grounds" on tuning condenser rotors "open" condenser *No. 14*, *23* or *34*
Hum	1)	"open" section in condenser *No. 23*
Hum (in Model 52 only)	1)	Some of the first receivers were incorrectly wired. Reverse the primary of the output transformer (the *green* and *white* wires) at the speaker terminal strip
Correct "dress" of wiring for best operation	1)	make sure that *red* wire from 1st i-f transformer primary to the 0.05-mfd. condenser goes straight down to the corner of the i-f tube socket and then straight up to the condenser lug. Also, the wire from the plate of the detector-oscillator tube to the coupling-compensating condenser must be away from the chassis

PHILCO 53 AC-DC

Inoperative	1) 2) 3)	"open" condenser *No. 30* or *31* (indicated by low overall plate voltage) "shorted" condenser *No. 5*, *25*, *30* or *31* "open" primary in output transformer *No. 26*
Intermittent reception	1)	"open" condenser *No. 20*—see *Note* (*A*) listed under "Philco Receiver General Service Data" at beginning of Philco case histories
Weak reception	1) 2)	"open" condenser *No. 11* "open" in i-f transformer *No. 13*—indicated by ineffectiveness of padder *No. 18*—see *Note* (*B*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Low volume (plate and screen-grid voltages low)	1) 2) 3)	defective type '12Z3 rectifier tube (even though it may test O.K.). Replace with a new tube defective type '38 tube (even though it may test O.K.). Replace with a new tube low heater voltage on the rectifier tube. This should be about 12-volts as rated
Distortion at low volume	1)	"shorted" condenser *No. 20*
Distortion at high volume, Weak, "tinny" signal	1) 2)	"shorted" section in condenser *No. 5* "shorted" primary in output transformer *No. 26* (indicated by "frying" noise)
Whistling or squealing	1) 2)	"open" regeneration winding in i-f transformer *No. 13*—indicated by ineffectiveness of padder *No. 18*—see *Note* (*B*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories "open" section in condenser *No. 5*

PHILCO 54 AC-DC

Inoperative
1) "shorted" condenser *No. 15, 31* or *41*
2) "open" field coil *No. 39* (sometimes indicated by "frying" noise)
3) "open" primary in output transformer *No. 37*
4) "inter-winding short" in i-f transformer *No. 23* (indicated by motorboating sound)—see *Note* (*C*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
5) "inter-winding short" in i-f transformer *No. 19*—see *Note* (*C*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
6) "open" in oscillator coil winding connected to 6A7 anode grid

Inoperative, Weak reception (plate voltage all low)
1) "open" condenser *No. 15* or *No. 41*

Weak reception
1) faulty 77 tube
2) check volume control for change in resistance
3) "open" i-f pickup coil—check bank-wound coil especially
4) check electrolytic condenser *No. 15*
5) "open" antenna transformer *No. 3*

Intermittent reception
1) locate the two-coil assembly (coils No. 2 and No. 7) (under the chassis) that is riveted to a small bracket. Check the rivets that hold the aluminum shield to the bracket where coils are fastened. The ground returns of the coils are through the brackets, and when the rivets aren't making good contact between the coil shield and the brackets it is bound to act the same as an intermittent by-pass condenser, and the condensers are usually blamed. Either hammer the rivets, or run a wire to the ground returns of the coils, and solder the wire to chassis. Better still, do both
2) "open" condenser *No. 31*—see *Note* (*A*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
3) "open" condenser *No. 6A* (on later runs only)
4) "open" oscillator transformer *No. 10*

High-frequency squeal, Insensitive
1) increase in value of volume control resistor from 250,000-ohms to about 5-megohms. Replace with a new unit
2) "open" condenser *No. 7* or *No. 15*
3) separate the plate and grid leads of i-f transformers
4) "shorted" i-f trimmer condenser
5) check 78 tube by substitution
6) receiver circuits out of alignment
7) check dual 12-3 mfd. electrolytic condenser
8) "partial open" in condenser pack *No. 7*

Fading, Motorboating, Dead on part of dial
1) replace coupling condenser, and the 51,000 and 5,000-ohm resistors of the oscillator circuit

Intermittent fading
1) intermittent short-circuit in oscillator coil

Unstable volume
1) replace dual condenser No. 54 located behind 43 tube. Heat from tube damages this condenser

(Cont'd)

PHILCO 54 AC-DC—*(Cont'd)*

Distortion
1) check wire-wound resistor at rear-right of chassis. The lower portion of this unit develops high contact-resistance, and gives the 75 tube triode-grid an incorrect bias. Clean the terminals and wire thoroughly. Resolder or replace unit
2) gradual increase in volume control resistance (due to wear) which changes the diode load

Distortion at resonance peak of station
1) "shorted" antenna transformer *No. 3*

Distortion at high volume, Weak, "tinny" signal
1) "shorted" primary in output transformer *No. 37* (indicated by "frying" noise)

Tunable hum
1) "partial open" in volume control *No. 25*

Hum
1) "grounded" compensating condenser *No. 20* or *No. 22* (on later runs only)
2) replace metal washers on resistors *No. 42* and *No. 46* with fibre ones (moisture absorption)

Hum, Distortion
1) loose antenna coil shield
2) separate the r-f wires from grid leads
3) partially "shorted" filter condenser. Replace
4) "grounded" i-f trimmer condenser. Repair
5) "grounded" volume control. Repair
6) eliminate grounds to chassis, generally at network of AVC resistors or grid lead of '75 tube

Audio howl
1) plate lead of the type '43 tube running in close proximity to the diode and grid leads of the type '75 second detector tube. Re-route the '43 plate lead to prevent any possible interaction
2) shift condenser *No. 36* to a position parallel with chassis

Buzzing noise
1) defective type '25Z5 tube

Noisy reception
1) replace defective dial-light

Code interference all over dial
1) receiver circuits out of alignment

Dial sticks
1) power transformer dropping wax on condenser gang

Vernier dial slips
1) oil bearings of gang condenser

PHILCO 57

Inoperative
1) "shorted" condenser *No. 23* or *No. 26*
2) "shorted" section in condenser *No. 30* (indicated by overheated rectifier tube)
3) "open" field coil *No. 29* (sometimes indicated by "frying" noise)
4) "open" primary in output transformer *No. 27*
5) "open" section in condenser *No. 30*
6) faulty resistor *No. 21*

Inoperative or intermittent, Weak
1) check for "open" or "high-resistance" between the mounting support of oscillator and r-f transformer (to which one end of the coil winding is soldered) and the chassis. This occurs through the rivets on the aluminum cans. Correct it by soldering a wire across these two lugs and thence to the chassis

(Cont'd over)

PHILCO 57—*(Cont'd)*

Inoperative or intermittent, Weak —*(Cont'd)*	2)	"open" condenser *No. 23*—see *Note* (*A*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	3)	see if *white* lead on coil is "shorted" to chassis. It passes over metal bracket holding coil in place. Re-run it under the coil bracket if frayed
Weak reception	1)	if regeneration "padder" has no effect, replace i-f transformer
	2)	"open" antenna coil winding
	3)	"open" volume control. Replace
Broad tuning	1)	oscillator circuit not functioning properly. The oscillator circuit is coupled to the first detector circuit by a pair of twisted wires. Remove one of these wires and replace with another about one inch longer. This will cure the oscillator trouble
Distortion and hum (in early Run receivers)	1)	"grounded" condenser *No. 30*
Distortion and hum (in Later Run receivers)	1)	check for "ground" between case of electrolytic condenser and edge of power transformer
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 23* or *No. 26*
Hum	1)	"open" condenser *No. 30*
Noisy tuning	1)	inspect for wax or tar between variable condenser plates (dripping down from power transformer above)
Frying noise	1)	tension screw on the roller bearing of the tuning condenser rubbing on the insulated can of the filter unit. Apply friction tape to insulate it—or place a cardboard container over the unit
	2)	"shorted" primary in output transformer *No. 27*
Whistling or squealing	1)	"open" condenser *No. 10, 23* or *31*—see *Note* (*A*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" regeneration winding in i-f transformer *No. 16* (indicated by ineffectiveness of padder *No. 19*)—see *Note* (*B*) listed under "Philco Receiver General Servicing Data" at beginning of Philco cas histories
	3)	"open" condenser *No. 30* (especially on early-run receivers)
Dial drive slips	1)	release end bearing on gang condenser. If dial still slips, remove drive mechanism, take apart and insert a thin shim under shaft top. Reassemble, and oil properly
Balancing	1)	make sure band switch is in "Broadcast" position. Be sure that low-frequency end of band is not adjusted on the image signal

PHILCO 58

See also Case Histories listed for Philco 57 receiver

Weak reception	1)	if regeneration "padder" condenser has no effect, replace the i-f transformer
	2)	"open" antenna coil winding
	3)	"open" volume control. Replace

PHILCO 59

Inoperative	1)	"shorted" section in condenser *No. 31* (indicated by overheating of rectifier tube)
	2)	"shorted" condenser *No. 22* or *No. 11*
	3)	"open" primary in output transformer *No. 23*
	4)	"open" field coil *No. 25* (sometimes indicated by "frying" noise)
	5)	"open" section in condenser *No. 31*
Fading	1)	defective type '77 second detector tube. Replace with new tube
	2)	intermittent short- or open-circuits in i-f transformers
Low volume, Inoperative on low-frequencies	1)	resolder all connections at antenna and oscillator coils
	2)	tighten all screws on tuning condensers
	3)	defective 6,000-ohm type '77 tube grid-bias resistor. Replace with new unit
	4)	defective 0.0014-mfd. type '77 tube grid by-pass condenser. Replace with new unit
	5)	receiver circuits out of alignment. Realign
	6)	if regeneration "padder" condenser has no effect, replace the i-f transformer
	7)	check i-f transformer *No. 13* (trouble indicated by fact that padder *No. 16* is ineffective)—see *Note* (*B*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Intermittent reception	1)	see the Case History for this trouble symptom listed for the Philco 54 receiver
	2)	if most stations drop to a low volume when set warms up (or cut out entirely), check the 0.09-mfd. second-detector screen by-pass condenser for "open." It is located just in front of the 42 power tube
	3)	"open" condenser *No. 19*—see *Note* (*A*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Intermittent reception at the high-frequency end of the dial, Inoperative at the low-frequency end	1)	defective 25,000-ohm, 1-watt type '77 detector-oscillator tube screen-grid resistor (it may test O.K. when cold). Replace with new unit
Unable to tune in stations (cuts out when jarred)	1)	tighten oscillator and i-f shield can nuts. Make sure there is a lock-washer under each nut
	2)	run a hot soldering iron over all joints
Noisy	1)	try new 77 tube
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 19* or *No. 22*
	2)	"shorted" primary in output transformer *No. 23* (indicated by "frying" noise)
Hum	1)	"open" condenser *No. 31*
Whistling or squealing	1)	"open" condenser *No. 19, 23* or *11*—see *Note* (*A*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" section in condenser *No. 31*
	3)	"open" regeneration winding in i-f transformer *No. 13* (indicated by ineffectiveness of padder *No. 16*)—see *Note* (*B*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

PHILCO 60

Inoperative	1)	if voltage check shows that voltage is very low in filter system, and zero at the 6A7 and 78 tubes, check the i-f padding condenser No. 17 for a "grounded" condition. This condenser is across the primary of the 1st i-f transformer, and is mounted on the chassis by means of a small screw and collar. The screw goes through a brass eyelet in the condenser. It may be tightened too much, squeezing the fibre insulator, allowing the eyelet to move so close to the padder terminal that the high voltage breaks down the insulation and jumps to ground. Loosen the nut—it is also well to replace the condenser
	2)	if there is no "B" voltage at sockets, check for a "short" from the *white* "B" lead of 2nd i-f transformer to the clamp that holds the wood bobbin inside the can. Replace wire—or put insulation sleeve over it
	3)	"leaky" or "shorted" section in condenser *No. 20*
	4)	"shorted" condenser *No. 39*
	5)	"open" field coil *No. 42* (sometimes indicated by "frying" noise)
	6)	"open" primary in output transformer *No. 40*
	7)	"shorted" condenser *No. 13* (indicated by resistor *No. 14* overheating)
	8)	"inter-winding short" in oscillator transformer *No. 15* (indicated by resistor *No. 14* overheating)
Inoperative at low-frequency end of both broadcast and short-wave bands	1)	invariably due to a "shorted" end plate segment of one of the two condenser gang sections. Since the plates are very closely spaced, it takes little to produce the failure. However, it is very easily remedied by simply bending the offending plate or segment to clear the short-circuit. The shorting plate should not be bent too far, especially in the oscillator tuning section, or dial calibration error will result and realignment will be necessary
Inoperative at one or more points of the tuning range, Noisy tuning	1)	flakes or burrs on the tuning condenser plates. The coil leads may be disconnected from the stators and high voltage applied while the gang condenser is being rotated throughout its full range. Arcing at the shorted points will burn away the burrs
Set cuts out entirely—or to a very low volume	1)	try touching the grid cap of the 6A7 tube with one finger and any metal part of the chassis with another finger simultaneously. If this increases the volume or restores operation, check for a high resistance or intermittent "open" in the secondary of the antenna transformer. This defect is quite difficult to find as when the set is warmed up all voltages check O.K. and as soon as the power is shut off for an ohmmeter check, the contact is back to normal
	2)	"open" condenser *No. 30* or *No. 33* — see *Note (A)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	3)	"open" i-f transformer *No. 16* or *No. 25*—see *Note (B)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	4)	"snapped" connections at lugs of oscillator coil
	5)	faulty volume control

(Cont'd)

PHILCO 60—*(Cont'd)*

Weak, distorted reproduction	1)	if a low plate voltage reading is obtained on the 75 tube, it is usually traced to a leaky 0.5-mfd. plate filter condenser, connected from the junction of the two 70,000-ohm carbon resistors in the plate circuit of the 75 tube to chassis. This condenser is one section of a 4-section by-pass block mounted between the sockets of the types 6A7 and 80 tubes
	2)	faulty 0.015-mfd. coupling condenser between the 75 detector plate and the grid of the 42 tubes. The condenser used in this position should have a terminal resistance of over 100 megohms when tested on a voltage of not less than 400 volts. Replace if its resistance is less
Poor selectivity	1)	in productions prior to Run number 6 of these models the selectivity may be improved by replacing the i-f transfomers. The first i-f transformer is replaced with part *No. 32-1304* and the second one with number *32-1305*. Connect the original primary tuning trimmer of the second i-f transformer to its secondary and reverse both of the primary trimmers. The second i-f transformer primary should be tuned with new part *No. 04000-A* which is the correct trimmer unit
Intermittent noise	1)	replace type '6A7 oscillator tube even though it tests O.K.
	2)	check 0.18-mfd. cathode by-pass condenser on 6A7 tube
Whistling or squealing, General instability	1)	add second 1-mfd. by-pass condenser across common 6A7 and i-f cathode bias resistor—or employ separate 4,000-ohm biasing resistor and 0.1-mfd. by-pass condenser for i-f stage
	2)	dress lead of *No. 1* i-f transformer underneath shield of i-f compensating condenser
	3)	"open" section in condenser *No. 20*
	4)	"open" section in condenser *No. 7* or *No. 8*—see *Note (A)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	5)	in early models having separate bias resistors and by-pass condensers for 78 i-f and 6A7 det.-osc. tubes, check for "open" 78 i-f tube cathode by-pass condenser
Distortion at resonance peak of station	1)	"partial open" in resistor *No. 47*
	2)	realign No. 2 i-f stage
	3)	"shorted" secondary in i-f transformer *No. 25* (Note: If transformer is replaced, be sure the right transformer is used, as there are two run numbers)
Distortion at low volume	1)	"shorted" section in condenser *No. 33*
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" section in condenser *No. 20*
	2)	"shorted" section in condenser *No. 33*
	3)	"shorted" condenser *No. 39*
Motorboating sound	1)	cut *green* lead from by-pass condenser can to trimmer condenser. Connect a 0.1-mfd. 600-volt condenser from trimmer to ground
Hum (often tending toward oscillation)	1)	replace the single condenser connected between one side of power transformer primary and ground by a dual condenser. Connect one lead from each of the dual

(Cont'd over)

PHILCO 60—*(Cont'd)*

Hum (often tending toward oscillation) —(*Cont'd*)		units to one side of transformer primary. Connect the other lead from each condenser to ground
	2)	cut the *green* lead from the padder to by-pass and replace with 0.1-mfd. 600-volt condenser from padder to ground
Hum (intermittently)	1)	check 0.25-mfd. condenser connected from last filter to ground (housed in metal condenser pack)
Intermittent loud buzzing similar to electric motor interference noise	1)	replace the 6A7 oscillator-first detector tube—even if it checks O.K.
Dial slipping	1)	the tension of the ball race reduction gear must be increased by removing the screws holding its cover to the chassis and bending the ends of the cover forward. On re-installing, the screws will force the cover further back in the reduction gear

PHILCO PT-61

Hum, Poor tone	1)	try disconnecting the AVC lead from the dead lug on the rectifier socket

PHILCO 65

Inoperative	1)	"open" primary in input transformer *No. 17* and output transformer *No. 28*
	2)	"open" speaker cone *No. 30* voice coil
	3)	"open" field coil *No. 29* (sometimes indicated by "frying" noise)
	4)	"open" speaker and tube socket contacts
	5)	"ground" inside shielding braid of lead to plate of *No. 1* r-f tube
	6)	"shorted" section in condenser *No. 20* (indicated by overheated rectifier tube)
	7)	"shorted" condenser *No. 5, 6, 9,* or *10*
	8)	"open" chokes *No. 21* and *No. 23*
	9)	"shorted" padders located at rear of tuning condenser and inside of frame (also may cause weak reception)
Inoperative excepting on strong local stations	1)	check for "short" between inside wire and shielding braid of shielded lead running from 1st r-f tube plate to r-f transformer under the shield that covers the entire second r-f stage
Intermittent reception, Fading, Inoperative, Weak reception	1)	leaky or short-circuiting 0.001-mfd. detector plate by-pass condenser
	2)	intermittent "open" in 3,000-ohm speaker field
	3)	poor contact in speaker plug—results in lack of output tube plate voltage and current
Weak reception on high-frequencies	1)	r-f circuits out of alignment
Hum, Distortion	1)	pilot-light socket lugs shorting to mounting bracket
	2)	corroded speaker plug and socket contacts
	3)	"open" section in condenser *No. 20*
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 15* (indicated by "frying" noise)
	2)	"shorted" primary in input transformer *No. 17* and output transformer *No. 28* (indicated by "frying" noise)

(Cont'd)

PHILCO 65—*(Cont'd)*

Whistling or squealing	1)	intermittently defective cathode by-pass condensers. Replace with new units
	2)	connect a 0.00025- or 0.0005-mfd. mica condenser from the "low" side of the detector plate choke to ground
	3)	bond both ends of the tuning condenser gang rotor to the frame and the latter in turn, to the chassis with flexible pigtail leads
	4)	"open" condenser *No. 5, 13* or *27*
	5)	"open" volume control *No. 25*
Crackling noise	1)	loose rivets on combination resistor and cartridge-type condenser in the first r-f tube plate circuit

PHILCO 66

Inoperative	1)	"shorted" section in condenser *No. 50* (indicated by overheated rectifier tube)
	2)	"shorted" condenser *No. 27, 34* or *46*
	3)	"open" or "grounded" choke *No. 48*
	4)	"shorted" condenser *No. 14* (indicated by resistor *No. 15* overheating)
	5)	"open' field coil *No. 37* (sometimes indicated by "frying" noise)
	6)	"open" primary in output transformer *No. 35*
Inoperative at low-frequencies, Cuts off at low end of dial	1)	end plates of tuning gang short-circuited
Noisy tuning, Inoperation at one or more points	1)	burrs or flakes on condenser gang plates. Burn with high voltage—all terminals disconnected
Intermittent reception	1)	"open" condenser *No. 40*—see *Note (A)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" i-f transformer *No. 18* or *No. 23* —see *Note (B)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Noisy reception, Intermittent reception if set is subjected to any vibration	1)	defective volume control
Noisy volume control	1)	isolate volume control from diode load circuit
Weak reception	1)	"open" contacts on waveband switch
Distortion at resonance peak of station	1)	"partial open" resistor *No. 44*
	2)	"shorted" secondary in i-f transformer *No. 23*
	3)	realign second i-f stage
Distortion at low volume	1)	"shorted" condenser *No. 31*
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 31*
	2)	"shorted" section in condenser *No. 34*
	3)	"shorted" condenser *No. 27*
Hum	1)	replace the single condenser connected between one side of power transf. primary and ground by a dual condenser. Connect one lead from each of the dial units to one side of transf. primary. Connect the other lead from each condenser to ground
	2)	"open" section in dual 8-8 mfd. filter condenser *No. 50*

(Cont'd)

PHILCO 66—*(Cont'd)*

Whistling or squealing	1)	see Case Histories for this trouble listed under Philco 60 receiver
	2)	"open" condenser *No. 51*
	3)	separate the grid and plate leads of i-f transformer
Whistling at high-freq. end of short-wave band	1)	in early-run receivers connect a 70-ohm wire-wound resistor (Part *No. 33-1129*) in series with condenser *No. 14* on the oscillator coil side
To increase response to high notes	1)	replace old tone control (Part *No. 30-4192*) with new type (Part *No. 30-4212*)

PHILCO 70, 70A

Inoperative, Type '27 tube lights up brightly	1)	second i-f transformer secondary winding short-circuited to primary winding. Dis-assemble and move leads
Inoperative (rectifier plates red hot)	1)	if filter condensers check O.K., inspect filament leads of tubes at rear of chassis at points where leads pass under primary trimmer condensers of i-f transformers. Leads sometimes come in contact with edges of condenser plates, the latter in time cuts through the insulation on wire, "shorting" entire "B" supply
Inoperative	1)	examine pigtails on various resistors, making sure they are not "shorted" to other parts (particularly the cond. lugs)
	2)	check connection between the cathode of the oscillator and the coil to which it connects. Resolder all joints in oscillator circuit
	3)	"shorted" oscillator section in tuning condenser
	4)	"open" speaker field coil (sometimes indicated by "frying" noise)
	5)	"open" output transformer primary
	6)	"shorted" condensers *No. 21, 28* and *No. 5*
Inoperative (tuning friction drive inoperative)	1)	worn front variable condenser bearings, permitting station recorder to drop and making friction drive inoperative. Take out rotor assembly and tin well with solder. Then run "babbitt" bearing metal (out of an old auto bearing) around shaft, and let it cool. Cut down to proper size with a rat-tail file
Intermittent reception	1)	tighten any loose screws on side of tuning condenser
	2)	check audio coupling condenser
	3)	check oscillator cathode by-pass condenser. This is a double unit—replace with 0.1-mfd. units
	4)	if elements in 47 tube overheat, replace tube
Intermittent reception (volume drops to about ⅛ of its original level—at any setting of volume control)	1)	replace audio coupling condenser between the plate of the 2nd detector tube and the grid of the 47 output tube
	2)	faulty 0.015-mfd. by-pass condenser at the a-c line. Replace
Fading on "locals," Intermittent reception	1)	open-circuiting r-f by-pass and audio coupling condensers, usually at the eyelet of the case. Replace with new style condensers having stranded wires at eyelets *Note:* the above condition is usually difficult to test but can usually be induced

(Cont'd)

PHILCO 70, 70A—*(Cont'd)*

Fading on "locals," Intermittent reception —*(Cont'd)*		by shorting across the blocking condenser several times in succession, causing the condenser to open; a 0.01-mfd. condenser bridged across it should bring the set back to full volume
	2)	defective type '47 tube. Replace
Weak reception all over the dial	1)	open-circuited auxiliary fixed condenser across the i-f padding condenser terminals
I-f transformers will not peak (serial No. below 22,000)	2)	open-circuited high-frequency feedback condenser. Replace with new unit
	3)	defective r-f choke
Low volume at the low-frequency end of the dial Distortion	1)	defective type '24 second detector tube (even though it may test O.K.). Replace by substitution with new tube
Low-freq. "padder" cannot be peaked	2)	open-circuited auxiliary low-frequency padding condenser
Weak reception at high-frequencies	1)	open-circuited low-frequency condenser across the low-frequency padder and the oscillator cathode bias resistor. Replace with a new condenser
Impossible to align circuit at 1400 kc	1)	look for "open" 0.00011-mfd. condenser between oscillator coil and plate of oscillator tube. Replace with a 0.0005-mfd. unit. Receiver will now align and be more selective than originally
Suppressor grid of the type '47 tube turns red-hot	1)	section of voltage divider between the high-voltage center tap of the power transformer and ground short-circuits when it becomes hot. Replace with a 240- to 300-ohm, 10-watt unit
Loud howl, Microphonics, Erratic tone control operation,	1)	change in capacity or open-circuit in 0.00025-mfd. condenser connected to the plate lead of the second detector tube next to the choke coil. Replace with a new unit
	2)	vibrating tuning condenser plates. Place a pair of rubber washers under the chassis so as to "float" it.
	3)	reverse the coil leads
	4)	try readjusting the padder condensers
	5)	in receivers bearing serial number below 22,000 check for "open" detector plate by-pass condenser on B-plus side of r-f choke
Distortion, (signal fades out completely)	1)	replace 0.25-meg. resistor in grid circuit of 47 tube
Distortion	1)	check speaker cone to see if it has stiffened. Replace
	2)	check the speaker. It is mounted with the output transformer on top, so that the sealing compound can run out and down around the voice coil. This compound has a low melting point and starts to run when the transformer is only warm. The remedy is to invert the speaker
	3)	if output quavers, check the volume control and the continuity of the oscillator coil
Distortion at low volume	1)	check 2nd det. tube by substitution
Distortion at high volume, Weak, "tinny" signal	1)	breakdown of insulation on primary of output transformer (indicated by "frying" noise)
	2)	"shorted" condenser *No. 33*

(Cont'd over)

PHILCO 70, 70A—*(Cont'd)*

Whistling or squealing	1)	if usual methods to cure oscillation fail, by-pass the filaments of the r-f and i-f tubes with capacities ranging between 0.005 and 0.25-mfd. Find best value by experiment
	2)	"open" section in condenser *No. 5*
	3)	"open" condenser *No. 12, 21, 23* or *28*—see *Note* (*A*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Whistling (not traceable to missing rubber cushions or floating condenser gang)	1)	caused by vibration of oscillator coil. Repair by dropping wad of paper in coil and with chassis upside down, drop beeswax from hot soldering iron point onto the paper. This will steady the coil
Intermittent noise	1)	defective type '47 tube bias section on voltage divider resistor. Replace with 180-ohm 10-watt unit
Noisy reception	1)	check grid connections on all tubes
	2)	check condition of volume control
	3)	peeling plates on tuning condensers. Burn with high voltage—all terminals disconnected
	4)	faulty output transformer primary
	5)	loose shield over oscillator and r-f transformers
Hum (on stations near center of band)	1)	look for trouble in the by-pass condensers across the a-c line input circuit
Hum (low-pitched)	1)	faulty 0.25-mfd. condenser in plate circuit of 24A 2nd detector. This condenser connects between the chassis and the junction of the 0.24-megohm and 45,000-ohm resistors used in series with the plate of the 2nd detector tube and the high-voltage lead
	2)	faulty condenser *No. 40*
Microphonics	1)	replace oscillator transformer *No. 8*
260 kc airport beacons cause interference	1)	readjust the i-f compensating condensers and the oscillator compensating condenser to either 250 or 270 kc
Obtaining smoother volume control	1)	replace dual volume control with a single, tapered unit which will give smoother volume control
Slipping dial-drive shaft	1)	pull the shaft down tight and solder thin washer to the bracket

PHILCO 71

Inoperative	1)	open-circuited shadowgraph
	2)	"shorted" condenser *No. 5, 7* or *33*
	3)	"shorted" section in condenser *No. 21*
Inoperative between 800 and 1500 kc,	1)	defective type '36 tube (even though it may test O.K.). Replace with new tube
Detector-oscillator tube fails to oscillate	2)	replace the 15,000-ohm detector-oscillator cathode resistor with a 10,000-ohm unit
	3)	moisture in oscillator coil. Replace with a well-impregnated coil
	4)	high-resistance connection to pigtails of r-f stage plate choke
Cuts out on strong local stations	1)	change the bias resistor on the autodyne oscillator from 15,000-ohms to 10,000-ohms

(Cont'd)

PHILCO 71—*(Cont'd)*

Intermittent reception	1)	snapped coil leads at lugs of oscillator coil
	2)	"open" condenser *No. 32* or *36*—see *Note* (*A*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Intermittent reception, (operation restored when analyzer plug is inserted for test)	1)	defective voltage-divider section between screen grid and cathode of second detector tube
Insufficient action of shadowgraph	1)	insufficient antenna. Lengthen antenna
	2)	weak type '44 tubes
	3)	remove shadowgraph from i-f plate circuit
Shadowgraph gradually widens out after receiver is turned on	1)	"gassy" tubes in r-f and i-f stages. Install two 44 tubes in these sockets
Whistling, Fading	1)	open-circuited r-f plate and screen by-pass condensers (connecting leads at eyelets or within housing)
	2)	open-circuited first detector or oscillator cathode by-pass condenser (connecting leads at eyelets or within housing)
	3)	loose oscillator or i-f coil shields. Solder at rivet
Whistling at high-frequencies only	1)	open-circuited first detector-oscillator tube cathode by-pass condenser
	2)	compensating condensers out of alignment
Distortion after receiver has been turned on for a few minutes	1)	trouble likely in AVC circuit. Check carefully (by substitution) the 0.05-mfd. r-f and i-f grid filters which are part of separate bakelite-encased dual units. Check also the 0.01-mfd. audio coupling condenser in the diode detector circuit, after replacing the 37 tube. Leakage in any of these condensers tends to remove control bias from the '44 tubes, producing distortion
	2)	replace 70,000-ohm first audio plate resistor with 50,000-ohm unit
	3)	replace 1-megohm grid resistor of 39/44 first audio tube with a ¼-megohm unit
Distortion at low volume	1)	"shorted" condenser *No. 36*
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 21*
	2)	"shorted" condenser *No. 38*
Hum	1)	clip dummy lug from condenser *No. 38* and move wiring away from the adjacent condensers as far as possible
Noise	1)	loose shields over oscillator and r-f transformers. Solder at rivets
Broken dial cable	1)	a woven dial cable is employed. On the dial where the cable fastens there will usually be found a sharp edge. If a cable is too tight this edge cuts the strands. To remedy: place a small section of Scotch Tape over the edge. This tape is flexible, transparent and may be obtained at almost any stationery store

PHILCO 71B

Intermittent reception	1)	intermittently defective condenser *No. 3*

PHILCO 76, 76A

See also Case Histories listed for Philco 77, 77A

Inoperative	1)	check the speaker socket. Clean and bend all contact pins so good contact is obtained. Also check the pin which is connected to the speaker field—as this often gives trouble
	2)	"open" speaker voice coil
	3)	"open" contacts on tube sockets
	4)	"shorted" section in condenser *No. 31* (indicated by overheated rectifier tube)
	5)	"shorted" condenser *No. 8, 13* or *16*
	6)	"open" section in broadcast band resistor *No. 27*
	7)	"shorted" section in condenser *No. 31*
Intermittent reception	1)	"open" condenser *No. 21*—see *Note (A)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	if opening and closing line switch restores operation, replace plate dropping resistors *No. 19* and *No. 20* with new 100,000-ohm units
Fading	1)	check ground strap from ground post to chassis for poor contact. Solder lead from post to chassis
Hiss (on all stations)	1)	increase the value of the detector cathode resistor just sufficiently to eliminate the hiss
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" primary in input transformer *No. 23* and output transformer *No. 24* (indicated by "frying" noise)
	2)	"shorted" section in condenser *No. 31*
	3)	"shorted" section in condenser *No. 16*
Distortion at low volume	1)	check the volume control, tubes, and voice coil alignment
Distortion	1)	check the audio coupling condenser
	2)	check centering of voice coil
Whistling	1)	"open" condensers *No. 8, 15, 16* or *13*
Noisy	1)	check and inspect all r-f transformer primaries. The wires usually break at the ends and make intermittent contact with the lugs
Hum, Inoperative (about 15 minutes after set starts)	1)	loose wire on r-f or i-f coil short-circuiting to soldering lug, thereby short-circuiting primary to secondary. Put wire back into original place and cement it in position
	2)	"open" section in condenser *No. 31*

PHILCO 77, 77A

Inoperative	1)	open-circuited 0.1-mfd. audio coupling condenser (connecting leads at eyelets or within case)
	2)	"open" choke *No. 27*
	3)	"open" field coil (sometimes indicated by "frying" noise)
	4)	"open" primary in input transformer and output transformer
	5)	"shorted" section in condenser *No. 28* (indicated by overheated rectifier tube)
	6)	"shorted" section in condenser *No. 7, 14* or *11*
Intermittent reception	1)	"open" condenser *No. 19*—see *Note (A)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Weak reception, Distortion	1)	open-circuited 0.1-mfd. audio coupling condenser
Distortion at low volume	1)	improperly centered dynamic speaker voice coil
	2)	interchange detector tube with an r-f tube

(Cont'd)

PHILCO 77, 77A—*(Cont'd)*

Distortion at high volume, Weak, "tinny" signal	1)	"shorted" primary in input transformer *No. 22* and output transformer *No. 31* (indicated by "frying" noise)
	2)	"shorted" section in condenser *No. 11, 14* or *28*
Hum	1)	"open" section in condenser *No. 28*
Whistling or squealing	1)	"open" condenser *No. 11*—see *Note (A)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" section in condenser *No. 7, 13* or *14*
Tuning condenser shifts off frequency	1)	stretched dial-drive cord
	2)	weak dial-drive cordspring. Replace with heavy duty type

PHILCO 80

Inoperative	1)	"open" resistor *No. 9* (indicated by high screen grid voltage)
	2)	"shorted" condenser *No. 27* or *No. 10*
	3)	"open" field coil *No. 30* (sometimes indicated by "frying" noise)
	4)	"open" primary in output transformer *No. 28*
Inoperative (no plate voltage on type '36 second detector)	1)	open-circuited 1-megohm screen-grid resistor. Replace with new unit
Inoperative (low, or no plate voltages)	1)	if filter condensers check O.K., look for a "short" between the wire connected to the B-plus terminal of the condenser and the chassis. Use a rubber covered wire
	2)	check *white* insulated wire serving as B-plus lead of the det.-osc. tube It often "shorts" to chassis
	3)	"compensating condensers "shorting" to chassis
Inoperative over portion of band	1)	inspect oscillator transformer *No. 8* for dampness. Replace
Intermittent operation (may be accompanied by oscillation)	1)	intermittently "opening" dual 0.09-mfd. bakelite-cased condenser by-passing screen-grid circuits of both 36 tubes (located between the rectifier and detector-oscillator sockets). Replace this block with two 0.1-mfd. units
	2)	check for intermittent line by-pass condenser (one section of a dual unit near the power transformer)
	3)	"open" condenser *No. 25*—see *Note (A)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Weak reception	1)	check 77 tube
	2)	check "mixer" cathode resistor for change in resistance
	3)	replace 240,000-ohm plate resistor if it has greatly increased in value
	4)	"open" i-f pickup coil. The one that is bank-wound is deceptive as the set balances without it
	5)	change 1-meg grid resistor to a 0.5-meg. unit—especially in models with a star stamped on chassis
	6)	"shorted" condenser *No. 37* (in early-run receivers only)
Noise	1)	high-resistance "short" in first i-f transf. primary wire
	2)	plate lead from i-f transf. to 1st '36 rubs coils base and insulation is punctured. Flashing-over occurs
	3)	grid resistor (No. 26) for 42 tube shorts to the 42 socket prong. Move it away

(Cont'd over)

PHILCO 80—*(Cont'd)*

Volume control ineffective on strong stations	1)	replace 0.05-mfd. r-f by-pass condenser *No. 35*
	2)	change volume control, using (Part *No. 3793B*) for replacement. Connect new unit with one end to antenna post and also to antenna coil, the other end to the i-f grid return, and the variable arm to ground. Connect the i-f grid return end to 2nd detector, anchored on encased-condenser lug to one side of chassis. Remove lead from condenser
Noisy volume control	1)	a noisy volume control in this and other Philco models using a similar style control, wherein a small sliding disc is used on the rotating arm, may be made very quiet in operation by simply removing this slider, cleaning it, and putting it back with the other side next to the resistance strip
Whistling (until receiver is thoroughly warmed up)	1)	77 tube which "shorts" intermittently
	2)	increase screen by-pass condenser to 0.5-mfd. or more
Whistling or squealing	1)	make sure that the i-f suppressor filter to the plate of the 2nd detector '36 tube is placed as far away from the i-f coils as possible. The *black-and-white* lead from the last i-f coil should be as close to the chassis as possible to minimize undesirable couplings
	2)	"open" condenser *No. 10* or *No. 37*—see *Note* (*A*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	3)	"open" regeneration winding in i-f transformer *No. 14* (indicated by ineffectiveness of padder *No. 18*)—see *Note* (*B*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 27* or *No. 38*
Aligning i-f stages	1)	care should be taken that the i-f stages are not peaked on an image or parasitic frequency—check this by rotating the tuning condenser and noting if the strength of the i-f signal changes
Loose rotor on tuning condenser gang	1)	remove assembly and take off rear bearing plate. Center punch the depression on this plate so that it protrudes further against shaft. If plates are out of line when the unit is assembled they can be realigned by loosening set-screws holding them to shaft

PHILCO 81

Inoperative	1)	if screen grid voltage is high, check for "open" resistor *No. 14*
	2)	if "frying" noise is heard, check for "open" field coil *No. 31*
	3)	"open" primary in output transformer *No. 29*
	4)	"shorted" condenser *No. 15, 24* or *28*
Inoperative over part of band	1)	inspect oscillator transformer *No. 12* for dampness. Replace
Whistling or squealing	3)	"open" section in condenser *No. 29*
	4)	"open" regeneration winding in i-f transformer *No. 14* (indicated by ineffectiveness of padder *No. 17*)—see *Note* (*B*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

(Cont'd)

PHILCO 81—*(Cont'd)*

Weak reception	1)	defective type '77 tube
	2)	open-circuited i-f pickup coil. *Note*: The one that is a bank-wound coil, is most deceptive, as the set will balance without it
Fading (accompanied by a hum or a squeal)	1)	"open" in one of the condensers in the a-c line input, or in the centertap of the power transformer
	2)	"open" condenser *No. 24*—see *Note* (*A*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Distortion at high volume, Weak, "tinny"	1)	"shorted" condenser *No. 24* or *28*
Noise	1)	high-resistance "short" in i-f transformer *No. 18*. Replace
Whistling or squealing (intermittent or steady)	1)	"open" regeneration winding in i-f transformer *No. 18*—indicated by ineffectiveness of padder *No. 21*—see *Note* (*B*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Aligning i-f stages	1)	see Case History for this listed under Philco 80 receiver
Microphonic noise	1)	prevent mechanical vibration of the long or short wave switch. Eliminate "end-play" between the first and rear bearings between which the mechanism vibrates. A lock-washer or suitable spring will serve the purpose

PHILCO 81T

Weak reception	1)	if all compensating condensers have been adjusted correctly, see if battery is being pushed against tuning condenser sections and misaligns tuning stages when back of cabinet is put in place. Pushing against condenser in this way changes capacity of condenser

PHILCO 84

Inoperative	1)	"grounded" compensating condenser *No. 11*
	2)	"shorted" section in condenser *No. 29* (indicated by overheated rectifier tube)
	3)	"open" field coil *No. 27* (sometimes indicated by "frying" noise)
	4)	"open" primary in output transformer
	5)	"shorted" condenser *No. 9, 20* or *24*
Weak reception	1)	defective type '77 tube
	2)	open-circuited i-f pickup coil *Note*: The one that is a bank-wound coil is most deceptive as the set will balance without it
Intermittent reception	1)	replace 6,000-ohm resistor connected from cathode of detector-oscillator tube through the primary of the oscillator coil to ground. Replace it with a 4,000-ohm unit (original resistance too high)
	2)	check 0.0014-mfd. condenser (No. 7) connected to oscillator coil
	3)	"open" section in condenser *No. 20*—see *Note* (*A*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	4)	"shorted" dual condenser section by-passing screens of 77 tubes
Whistling or squealing	1)	connect a 0.05-mfd. condenser from "high-voltage" to "ground"
	2)	"open" condenser *No. 9 or 28*—see *Note* (*A*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

(Cont'd)

PHILCO 84—*(Cont'd)*

Distortion at high volume	1)	"shorted" condenser *No. 20* or *No. 24*
	2)	if hum is also present, check for "shorted" condenser *No. 32*
Loud hum	1)	check rivet that holds 42 socket. Cathode lug often grounds to rivet
	2)	loose or corroded ground lug rivet for filament supply on 42 socket. Place an additional ground at this connection
	3)	"open" section in condenser *No. 29*
Impossible to reduce volume on locals	1)	shield first-detector tube and its grid lead if necessary
Improving tone and volume	1)	connect a 8-mfd. condenser from the *green* terminal of the electrolytic filter to ground
Aligning i-f stages of receiver	1)	see Case History for this listed under Philco 80 receiver

PHILCO 86

Inoperative	1)	"shorted" 0.1-mfd. condenser which is sealed into a cylindrical container along with the plate resistor. Disconnect the condenser lead and substitute separate 600-volt tubular condenser for it
	2)	"shorted" section in condenser *No. 33*
	3)	"open" field coil *No. 38* (sometimes indicated by "frying" noise)
	4)	"open" primary in input transformer *No. 26*, output transformer *No. 36* and a-f transformer *No. 22*
	5)	"shorted" condenser *No. 7, 12* or *17*
	6)	"shorted" section in condenser *No. 33* (indicated by overheated rectifier tube)
	7)	"open" pick-up jack, or "grounded" circuit
	8)	"open" speaker or tube socket contacts
	9)	"open" speaker voice coil
	10)	"open" choke *No. 34*
	11)	"grounded compensating condenser *No. 9, 14,* or *19*
Intermittent reception, Fading	1)	check for broken contacts on detector tube socket
Weak reception	1)	if hum is heard, check for "open" grid contact in range control switch *No. 4*
Poor "distance" reception, Broad tuning	1)	clean and tighten all wiper contacts on tuning condenser rotor
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" primary in a-f transformer *No. 22*, input transformer *No. 26* and output transformer *No. 36* (indicated by "frying" noise)
Distortion	1)	"shorted" condenser *No. 29* (indicated by presence of hum)
	2)	"open" section in resistor *No. 35*
	3)	"grounded" filament lug at top of pilot lamp bracket
Whistling or squealing	1)	"open" condenser *No. 7, 12, 17* or *29*
Hum	1)	"open" section in condenser *No. 33*
	2)	"open" center-tap in filament winding of power transformer
Low hissing sound (tubes test O.K.)	1)	defective first audio transformer. Substitute with new unit

PHILCO 87

Inoperative	1)	"open" speaker and tube socket contacts
	2)	"shorted" section in condenser *No. 31* (indicated by overheated rectifier tube)
	3)	"open" field coil *No. 38* (sometimes indicated by "frying" noise)
	4)	"open" primary in input transformer *No. 25*, a-f transformer *No. 22*, and output transformer *No. 36*
	5)	"open" voice coil
	6)	"grounded" compensating condenser *No. 9, 14 or 19*
	7)	"shorted" condenser *No. 7, 12* or *17*
	8)	"shorted" section in condenser *No. 31*
	9)	"grounded" or "open" choke *No. 32* or *No. 33*
Inoperative (no plate voltage on any r-f tube)	1)	"open" r-f plate circuit resistor (contained in by-pass block near base of r-f coil for that stage)
Weak reception, Fading	1)	inspect r-f trimmers to see if metal eyelets in insulators supporting them are "shorting" to trimmer stators
	2)	"open" secondary in a-f transformer *No. 22* and input transformer *No. 25*
	3)	if hum is also heard, check for "open" grid contact in range control *No. 4*
Unstable, Neutralization of tuned circuits impossible	1)	check all three r-f plate circuit resistors which are wound directly on 0.1-mfd. condensers. These usually open-circuit, causing excessive oscillation
	2)	"open" condenser *No. 7, 12, 17* or *27*—see *Note (A)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Distortion, Hum	1)	"shorted" condenser *No. 27* (indicated by presence of heavy hum and distortion)
	2)	"grounded" potentiometer *No. 28* (indicated by presence of heavy hum)
	3)	"grounded" filament bus line (indicated by presence of heavy hum)
Distortion at high volume, Weak, "tinny" signal	1)	"grounded" filament lug at top of pilot lamp bracket
	2)	"open" section in resistor *No. 35*
	3)	"shorted" section in condenser *No. 31*
	4)	"open" primary in a-f transformer *No. 22*, input transformer *No. 25* and output transformer *No. 36* (indicated by "frying" noise)
Hum	1)	corroded or open friction contact on range control
	2)	receiver out of neutralization
	3)	defective filter condenser
	4)	"shorted" twin 0.25-mfd. by-pass condensers across the type '26 tube filaments. Replace if their d-c resistance is less than 25 megohms. (These condensers are in long can in front of chassis.) Set hum control
	5)	series plate resistors in r-f section faulty. They are located in the cartridge plate by-pass units
	6)	"open" center tap in filament winding of power transformer
	7)	"open" section in condenser *No. 31*
Crackling, noisy	1)	replace 3,785-ohm section of *R8* with 20-watt 3,000-ohm and 750-ohm units in series
	2)	check audio transformer—especially for noisy primary

PHILCO 89 (Codes 121, 122 and 123)

See also Case Histories listed for Philco 19 (Codes 121, 122 and 123) receivers

Inoperative (completely), Inoperative over a portion of the dial, Intermittent operation	1)	see remedies listed under *Inoperative* and *Intermittent* operation for Philco Model 19 receiver
	2)	try reversing primary leads of the first i-f transformer
	3)	"grounded" compensator at back right hand side of set. Remove and insulate
	4)	change first det.-oscill. cathode bias resistor to one of 8,000 ohms
	5)	imperfect connections on oscillator coil, or at tuning condenser stator. Resolder all connections here
Weak, distorted reception	1)	**poor type '76 tube in second detector AVC stage**
Weak reception on low-frequency end of dial	1)	**reverse the primary leads on first i-f transformer**
Fading	1)	faulty oscillator coil or connections. Check both the overall resistance of each winding as well as leakage between windings
Short-wave and code interference on broadcast signals	1)	connect a 0.0025-mfd. mica condenser in series with antenna and ground. Bond waveband switch and contact springs to chassis
Howling on strong signals (due to acoustic feedback)	1)	remove the speaker and place several thin pieces of rubber between the cabinet and the speaker rim. (Pieces cut from an old inner tube may be used with excellent results.) This is best accomplished with the cabinet lying on its face. The mounting nuts should be turned up not too tightly but firm enough so that any vibration will not jar them loose
Hum on carrier	1)	"shorted" cathode by-pass condenser of second detector tube
Hum	1)	**dried-up electrolytic condensers**
Whistling or squealing	1)	"open" 1st det. grid coil
	2)	replace 150,000-ohm oscillator cathode bias resistor with 10,000-ohm unit
Distortion on loud signals	1)	connect a 1-megohm resistor from 75 tube grid to chassis
Noisy reception	1)	rewire oscillator coil
	2)	"partial open" in primary of 2nd i-f transformer

PHILCO 89 (Code 128)

Inoperative	1)	"inter-winding short" in i-f transformer *No. 20* (indicated by motorboating sound)—see *Note* (*C*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"shorted" condenser *No. 4*
	3)	"shorted" condenser *No. 48*
Intermittent reception	1)	"open" in i-f transformer *No. 15*—see *Note* (*B*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" condenser *No. 26* or *No. 41*
Distortion at resonance peak of station	1)	"partial open" resistor *No. 32*
Distortion at low volume	1)	**"shorted" condenser *No. 41***

(Cont'd)

PHILCO 89 (Code 128)—*(Cont'd)*

Distortion at high volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 4*
	2)	"shorted" condenser *No. 48*
	3)	"shorted" condenser *No. 41*
Hum	1)	"open" condenser *No. 37* or *No. 38* (in some runs only)
Whistling or squealing	1)	"open" condenser *No. 4*, *9* or *17*

PHILCO "90" SERIES (All Models)

See also Case Histories listed for Philco 90 (with push-pull '45s), Philco 90 (with single '47 output tubes), Philco 90 (with push-pull '47s)

Inoperative	1)	"dead" oscillator (despite normal circuit conditions)
Inoperative on high-frequency end of dial	1)	shunt a 10,000-ohm resistor across oscillator cathode bias resistor
Weak reception all over the dial	1)	**open-circuited fixed condenser across the i-f padding condenser terminals**
	2)	**open-circuited high-frequency feedback condenser. Replace with new unit**
	3)	"open" antenna coil
Weak, distorted reception	1)	**open-circuited audio coupling-condensers (connecting leads at eyelets, or within housing)**
Intermittent reception	1)	faulty i-f trimmer condenser—usually the first i-f secondary trimmer (can be reached from back of chassis)
Feedback (untraceable to missing rubber cushions or floating condenser gang)	1)	**caused by vibration of the oscillator coil. Repair by dropping wad of paper in coil and with chassis upside down, drop beeswax from hot soldering iron point onto the paper. This will steady the coil**
Microphonics, Noisy reception	1)	re-adjust padder condensers until the trouble disappears
	2)	loose oscillator coil shield. Solder to chassis
Microphonic howl (stops if i-f or oscillator coil cans are squeezed)	1)	**loose leads in coil forms. Remove coil assemblies and melt paraffin over coil forms so as to hold leads solidly in place**

PHILCO 90, 90A—(with push-pull '45s)

See also Case Histories listed for Philco "90" SERIES (All Models)

Inoperative	1)	"open" resistor *No. 47*
	2)	"open" choke *No. 35*
	3)	"shorted" condenser *No. 9*, *25* *28* or *29*
	4)	"open" field coil *No. 32* (sometimes indicated by "frying" noise)
	5)	"open" primary in input transformer *No. 27* and output transformer *No. 30*
	6)	"shorted" oscillator section of tuning condenser
Intermittent reception	1)	check for loose screws which hold bakelite mountings on tuning condenser
	2)	"open" condenser *No. 46*—see *Note* (*A*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

(Cont'd)

PHILCO 90, 90A—(with push-pull '45s)—*(Cont'd)*

Fading only when chassis is touched (tubes and voltages check O.K.) (normal volume resumed when test is made)	1)	open-circuiting 0.01-mfd. condenser connected between the detector plate and the grid of the first audio tube . Replace with a new unit
Distortion at low volume	1)	"shorted" condenser *No. 46*
Distortion at high volume, Weak, "tinny" signal	1) 2)	"shorted" condenser *No. 28* "shorted" primary in input transformer *No. 27* and output transformer *No. 30* (indicated by "frying" noise)
Whistling or squealing	1)	"open" condenser *No. 9, 23* or *10*
Harsh tone	1)	replace stiff speaker cone
Microphonic	1)	replace oscillator transformer *No. 44*
Noise	1)	check for loose shields over oscillator and r-f transformers
No control of volume, Low volume	1)	intermittently open-circuiting coupling condenser connected between the "detector-rectifier" output resistor and the volume control. Replace with a new unit

PHILCO 90, 90A—(with single 47 output tube)

See also Case Histories listed for Philco "90" SERIES (All Models)

Inoperative	1) 2) 3) 4)	"shorted" condenser *No. 30, 24* or *47* "open" field coil *No. 34* (sometimes indicated by "frying" noise) "open" primary in output transformer *No. 32* "shorted" oscillator section on tuning condenser
Inoperative over portion or all of band	1)	"open" or "partial open" condenser *No. 44*
Intermittent reception	1) 2) 3) 4)	"open" condenser *No. 18, 23* or *28*—see *Note* (*A*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories replace type *No. 47* tube (indicated by overheated elements) check for loose screws which hold bakelite mountings on tuning condenser check coupling condensers between first and second 27 tube, between second and third 27 tube, or between third 27 tube and 47 output tube
Distortion at high volume, Weak, "tinny" signal	1) 2)	"shorted" condenser *No. 24* or *30* "partially open" primary in output transformer *No. 32* (sometimes indicated by "frying" noise)
Whistling or squealing	1)	"open" condenser *No. 30, 35, 38* or *47*—see *Note* (*A*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Microphonic	1)	replace oscillator transformer *No. 37*
Noise	1)	check for loose oscillator and r-f transformer shields

PHILCO 90, 90A—(with push-pull '47s)

See also Case Histories listed for Philco "90" SERIES (All Models)

Inoperative	1) 2) 3) 4)	"open" field coil *No. 43* (sometimes indicated by "frying" noise) "open" primary in output transformer *No. 41* and input transformer *No. 39* "shorted" condenser *No. 9* or *23* if various condensers check O.K., see if some resistor leads are grounding to chassis or other parts
Inoperative over high-freq. end of band	1) 2)	inspect oscillator transformer *No. 12* for dampness. Replace replace cathode resistor *No. 14* with 10,000-ohm value
Intermittent, operation, Fading	1) 2) 3) 4) 5)	clean condenser rotor-wiping contacts tighten all connections check audio coupling condensers between first and second 27's or between second and third 27's, or between third 27 and 47 final amplifier. Often the lead to a coupling condenser is broken check for loose screws holding bakelite mountings on tuning condenser "open" condenser *No. 35* or *No. 30*—see *Note* (*A*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Periodic fading, Weak reception	1) 2) 3)	replace all three No. 3909 (L.M.R.) condensers extending one behind the other from tone control to speaker plug if only the locals fade, check the 1-mfd. condensers. Use sharply pointed test probes to locate the faulty unit, gently lifting up the wires that come out of the hard-rubber case which houses the condensers faulty pentode tubes (even though they may test O.K.)
Whistling (between 1,100 and 1,500 kc when trimmers are adjusted to resonance)	1)	shunt a 0.1-mfd. 200-volt condenser across first r-f '24 tube and 27 oscillator tube 5,000-ohm cathode resistors
Whistling or squealing	1) 2) 3)	realign i-f system at 240 kc "open" condenser *No. 9* or *No. 23*—see *Note* (*A*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories "open" condenser *No. 7* or *No. 6*—see *Note* (*A*) listed under Philco Receiver General Servicing Data" at beginning of Philco case histories
Motorboating sound	1) 2)	replace the first audio grid resistor with a 100,000-ohm unit change a-f coupling condensers to 0.1-mfd. condensers instead of the original 0.01-mfd. units
Audio howl	1) 2)	check tubes for microphonics if tubes are O.K., check for control shafts or chassis touching front of cabinet, and also for correct functioning of rubber cushions. Vibration frequently causes oscillator plates to vibrate, causing tuning change and howl
Noisy reception	1)	defective 0.01-mfd. coupling condensers connected from the diode detector to the detector amplifier tube; the plate of the detector-amplifier tube to the grid of the first a-f tube; and the plate of the

(Cont'd over)

PHILCO 90, 90A—(with push-pull '47s)—(Cont'd)

Noisy reception —(Cont'd)		first a-f tube to the grid of the pentode tube. Replace with 0.1-mfd. tubular condensers and the a-f grid-leak resistors with 100,000-ohm units
	2)	loose oscillator or r-f coil shields
Hum	1)	caused by coupling as a result of the close proximity of the audio stages to the rectifier. Insert a shield plate (obtainable from the manufacturer) between the pentode tube and the rectifier tube
	2)	slow-heating or defective type '27 first audio tube (even though it tests O.K.). Replace with new tube
	3)	defective type '47 pentode tube (even though it tests O.K.). Replace with new tube
	4)	"shorted" condenser *No. 50*
Distortion at low volume	1)	"shorted" condenser *No. 35*
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" primary in input transformer *No. 39* and output transformer *No. 41* (indicated by "frying" noise)
	2)	"shorted" condenser *No. 23*
260 kc airport beacon interference	1)	readjust the i-f compensating condensers and the oscillator compensating condenser to either 250 or 270 kc
Slipping dial drive shaft	1)	pull shaft down and solder thin washer to bracket

PHILCO 90 (Codes 121, 222)

See also Case Histories listed for Philco 14 and Philco "90" SERIES (All Models) receivers

Shadowgraph inactive	1)	try several 44 r-f and i-f tubes as the old ones may not pass enough current to properly operate the shadowgraph
	2)	disconnect the i-f circuit from the shadowgraph and allow only the r-f tube to operate it
No shadowgraph indication on weak signals (O.K. on strong sigs.)	1)	change 44 r-f and i-f tubes
Gradual widening out of the shadowgraph after ten or fifteen minutes of operation	1)	replace two 44 r-f and i-f tubes. They may test O.K. but due to gas they gradually draw a higher and higher plate circuit — eventually burning out the shadowgraph through which this current flows
Inoperative between 800 and 1500 kc, Detector-oscillator tube fails to oscillate	1)	defective type '36 tube (even though it may test O.K.). Replace
	2)	replace the detector-oscillator cathode resistor with a 10,000-ohm unit
	3)	moisture in oscillator coil. Replace with well-impregnated coil
Cutting off of signals when dial is tuned	1)	rotor plates of tuning condenser "shorting" to stators
	2)	gang condenser stator lug grounds on the frame when knob is turned. Bend it away
Cutting off of signals (reception O.K. if power switch snapped off and on a few times)	1)	faulty 0.01-mfd. bakelite-case a-f coupling condensers connected between the 2nd det.—det. rect., and in the first and second a-f stages. The audio units cause most frequent trouble. Replace all with 0.01-mfd. 600-volt tubular units
Cuts off at 750 kc	1)	lowered value of 8,000-ohm cathode resistor

(Cont'd)

PHILCO 90 (Codes 121, 222)—(Cont'd)

Fading of "locals"	1)	failure of a 1-mfd. condenser. Probe the units, lifting up the wires that come out of the hard-rubber case which houses the condenser
Whistling or squealing	1)	plate and grid leads pushed out of place. Put the wires back to the position they were in when the set left the factory. If this does not help, remove i-f coil, put a metal washer at the open end, and replace coil
Volume control noisy (new one only cures noise temporarily)	1)	disconnect the end of the control that goes to the detector and from this detector lead connect a 300,000-ohm ½-watt resistor to ground. Also from this lead bridge a 0.06-mfd. condenser to the disconnected end of the volume control. This removes the d.c. from the control and permits quiet operation
Distortion at "bass" positions of tone control	1)	faulty condenser in the tone control
	2)	critical first i-f tube. Try another
Motorboating sound	1)	spider of speaker cone has lost its tension. Replace cone and spider unit
No control of tone	1)	defective type '37 tube in the first a-f stage (even though it tests O.K.). Switch the tubes in the second detector and first a-f tube sockets
Tuning dial slips	1)	increase the tension on the dial cord by moving up the tension spring one or a few notches
	2)	apply some rosin or warm tallow from a candle to the dial cord

PHILCO 91X

Set inoperative, Shadowgraph closed	1)	a full shadow extending completely across the scale indicates excessive current through the shadowgraph coil. This is frequently caused by a "grounding" of the common r-f and i-f plate lead where it leaves the coil box of the shadowgraph. Inasmuch as this shorts the power supply, it may be well to check the condition of the power transformer, the filter chokes, and the rectifier tube also
Set inoperative, Shadowgraph inactive	1)	sometimes the coil movement of the shadowgraph will burn out, thus opening the plate circuits of the r-f and i-f tubes. A temporary repair can be made by "shorting" the shadowgraph terminals until the unit can be replaced
Inoperative at high or low frequencies	1)	poor type '36 tube
	2)	reduce value of detector-oscillator cathode bias resistor
Intermittent reception	1)	snapped coil leads at lugs of oscillator coil
Insufficient shadowgraph action	1)	small antenna. Increase size
	2)	weak type '44 tubes in r-f and i-f stages
	3)	increase value of diode detector secondary-return resistor
Broad tuning	1)	r-f and i-f compensating condensers out of alignment
Whistling or squealing	1)	compensating condensers out of adjustment
	2)	remove all leads adjacent to oscillator coil
Motorboating sound, Hum	1)	eliminate by connecting 100,000-ohm resistor from first audio grid to chassis

(Cont'd)

PHILCO 91X—*(Cont'd)*

Hum (develops after few hours of use)	1)	replace input push-pull audio transformer. Secondary windings are often faulty
Distortion (plate voltage exists on grid of second detector)	1)	primary leads inside the can of the second i-f transformer cross the secondary winding, breaking down the insulation where they come in contact. Clear the primary leads (which are held in place by wax). This condition may be intermittent
No control of tone	1)	check type '37 tube in first audio stage

PHILCO 95, 96, 96A

See also Case Histories for Philco "90" SERIES

Inoperative	1)	check the 250-ohm resistor in series with the screens of the three r-f tubes
	2)	check the screen-grid by-pass condensers
	3)	if rectifier tube elements overheat, check for "shorted" section in filter condenser unit
	4)	"shorted" condenser *No. 8, 10, 11* or *31* in Model 95. "Shorted" condenser *No. 8, 9, 16, 17* or *31* in Model 96
	5)	"open" filter choke
	6)	"open" speaker and tube socket contacts
	7)	"open" field coil (sometimes indicated by "frying" noise)
	8)	"open" speaker voice coil
	9)	"open" primary in input transformer or output transformer
Intermittent reception (volume increases to high level and drops back to normal when test instruments are applied to circuit)	1)	intermittently defective by-pass condenser on "low" side of volume control Replace with a 0.5-mfd. tubular condenser between the "low" end of the volume control and the grounded lug of the nearest trimmer
Intermittent reception, Fading, Weak reception	1)	open-circuited or open-circuiting 0.05-mfd. r-f secondary-return by-pass condensers (at eyelets or within housing)
Intermittent reception (model 96)	1)	if any attempt to make test restores operation, replace the 30,000-ohm metalized resistor in first audio plate circuit
	2)	test by substitution the coupling condenser connected between the det.-amplif. plate and one side of the volume control. This unit may "open" or "short"
	3)	"open" primary in push-pull input transformer
Weak reception (voltages O.K.)	1)	check by-pass condenser used in the r-f transformer secondary circuits. Bridge each with a new 0.05-mfd. unit until the faulty one is found
	2)	replace the condenser from the "low" side of the volume control (Part *No. 3754*)
	3)	replace coupling condenser *No. 3788A*
	4)	if reception is weak only at low-frequency end of dial, suspect the antenna coil which is composed of approximately 250 turns of resistance wire at approximately 10 ohms per foot. Rewind with 100 turns of No. 26 or No. 28 copper wire
Weak reception (voltages O.K.) —*(Cont'd)*	5)	if detector-amplifier tube of a Model 96 receiver is not receiving plate voltage, check the 0.25-megohm *white* plate resistor No. 22.
Weak reception (intermittently)	1)	"open" condenser *No. 6, 12,* or *16* in Model 95 receiver. "Open" condenser *No. 5, 11* or *13* in Model 96 receiver—see *Note (A)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
"Blocking," (similar to very slow recovery of AVC. Set otherwise normal)	1)	replace volume control
"Ringing" sound in speaker when set is removed from cabinet		
Whistling, Intermittent reception	1)	"open-circuiting" screen by-pass condensers (at eyelets within housing)
	2)	check r-f by-pass condensers
	3)	if the 70,000-ohm screen bleeder resistor becomes "open", the screen voltages will be above normal and oscillation will result
Whistling at low-frequencies	1)	install a double 0.25-mfd. unit as a filament by-pass for the '24 tube filament circuit. Each condenser is to by-pass one side of the filament circuit to ground. Rebalance the receiver
Serious oscillation, Not traceable to open-circuited condenser or resistor	1)	replace screen feeder resistor with 50,000-ohm, 1-watt replacement, and by-pass with 2-mfd. condenser
	2)	by-pass the a-c line with a 0.001-mfd. condenser
	3)	install a 0.05-mfd. condenser from input transformer secondary center-tap to ground
	4)	see that shielding cover of screen-grid tubes is in place
	5)	make sure that a good ground connection is provided for the set
Tuning condenser shifts off frequency	1)	stretched dial-drive cord
	2)	weak dial-drive cordspring. Replace with heavy-duty type
"Blasting" at full volume	1)	"open" 0.5-mfd. condenser connected to the junction of the volume control and the 70,000-ohm resistor. The unit is located in the filter block, but may be replaced with an external unit
Intermittent howl	1)	replace the carbon volume control
Noises like static	1)	faulty a-f transformer winding
Distortion (at all volumes)	1)	check for pilot light wires "shorting" to chassis. This removes the bias from the output tubes
Distortion at low volume (also weak reception at low-freq. end of dial)	1)	check type *No. 27* detector tube by substitution

(Cont'd)

(Cont'd over)

PHILCO 95, 96, 96A—*(Cont'd)*

Distortion at high volume, Weak, "tinny" signal	1)	"shorted" primary in input transformer and output transformer (indicated by "frying" noise)
	2)	check for "grounded" filament lugs at top of pilot lamp bracket.
	3)	"shorted" section in filter condenser
	4)	"shorted" condenser *No. 31*
Hum	1)	"open" section in filter condenser
Volume control unable to cut volume down to zero	1)	"open" section in filter condenser

PHILCO 97

Inoperative	1)	"shorted" condenser *No. 61* (indicated by *wide* tuning meter shadow)
	2)	"shorted" section in condenser *No. 44*
	3)	"shorted" condenser *No. 40* or *No. 54*
	4)	"shorted" condenser *No. 35* (indicated by resistor *No. 36* burning)
	5)	"open" primary in input transformer *No. 53*
	6)	"open" primary in output transformer *No. 55*
Intermittent reception	1)	"open" condenser *No. 45*—see *Note* (*A*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" in i-f transformer *No. 33* or *No. 38*—see *Note* (*B*) listed under "Philco Receiver General Servicing Data at beginning of Philco case histories)
Distortion at resonance peak of station	1)	"partial open" resistor *No. 58*
	2)	realign second i-f stage
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" section in condenser *No. 44*
	2)	"shorted" primary in input transformer and output transformer (indicated by "frying" noise)
Whistling or squealing	1)	"open" condenser *No. 44* (indicated by motorboating sound)
	2)	"open" condenser *No. 7, 9, 40* or *61*—see *Note* (*A*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
High interstation noise (no noise with station on)	1)	"leaky" winding in the r-f transformer feeding plate of the r-f tube. Replace transformer

PHILCO 105

Line switch and volume control hard to turn on	1)	file away corner of plate on control shaft where it engages fibre roller at end of flag
Whistling or squealing at high volume	1)	push audio leads down close to chassis to reduce audio coupling—especially 7C6 tube grid leads to volume control and output transformer leads

PHILCO 111, 111A, 112, 112A

Inoperative	1)	faulty 70-ohm resistor in the high-voltage return circuit. It is located near the rectifier socket and is connected from ground to the high-voltage centertap
	2)	open-circuited 110-mmfd. mica oscillator coupling condenser. Replace
	3)	open-circuited 13,000-ohm oscillator plate-supply resistor. Replace

(Cont'd)

PHILCO 111, 111A, 112, 112A—*(Cont'd)*

Inoperative —*(Cont'd)*	4)	if set bears a low serial number, check oscillator coils for broken wires
	5)	if rectifier tube overheats, check filter condenser for "shorted" section
	6)	"open" field coil (sometimes indicated by "frying" noise)
	7)	"open" primary in input transformer or output transformer
	8)	"open" filter choke
Inoperative (high control-grid voltages on the type '24 tubes) (resistors and condensers check O.K.)	1)	dial-lamp receptacle or wiring to it short-circuiting to chassis
Inoperative over part of band, Intermittent reception	1)	"open" condenser *No. 19* in Model 111 and 112 receivers
Intermittent volume (low voltages on the types '27 and '45 tubes)	1)	open-circuited primary and secondary a-f input transformer windings. Replace the transformer
Intermittent reception, Fading, Weak reception	1)	open-circuiting or open-circuited 0.05-mfd. r-f and i-f secondary-return by-pass condensers
	2)	imperfect contacts at tube socket prongs and speaker plug
	3)	poor connections at lugs of first i-f coil. Resolder
	4)	"open" 110-mmfd. mica oscillator coupling condenser. Replace
	5)	"open" 13,000-ohm oscillator plate resistor
	6)	to improve reception and eliminate a few of the causes of intermittent reception, simply remove the following black-cased resistors and condensers: *3615L, 3615B* (one near the front of the chassis) *3615C* and *3615S*. The connections can be bridged and the parts left in the chassis, if desired. If the parts are removed, connect the wires together as each part is taken out
Fading, followed by whistling or squealing	1)	intermittent "opening" of 0.05-mfd. condenser between cathode and "low" end of r-f stage
Fading (tuning condenser shifts off frequency)	1)	stretched dial-drive cord
	2)	weak dial-drive cord spring. Replace with heavy-duty type
Weak reception, Distortion, Noisy	1)	check for "open" or "short" in windings of audio transformers
Weak reception (111 and 111A receivers)	1)	if all voltages check O.K., replace ½-meg. resistor No. 44 in detector plate circuit
Weak reception (112 and 112A receivers)	1)	check 15,000-ohm resistor between minus of speaker field and chassis for decrease in value. Replace with 5-watt unit
Weak reception, Poor tone (111 and 112 receivers)	1)	replace resistor No. 8 with a 75,000-ohm unit

(Cont'd)

PHILCO 111, 111A, 112, 112A—*(Cont'd)*

Whistling or squealing, Distortion	1)	if this occurs when sensitivity switch is snapped to "max" position, check for an open 0.5-mfd. condenser located in filter block by-passing screens of first detector and i-f
	2)	"open" section in filter condenser unit
	3)	"open" by-pass condensers—see *Note (A)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Distortion (Model 112 receiver)	1)	check for change in value of 15,000-ohm 5-watt carbon resistor connected between speaker return circuit and ground. Replace with wire-wound unit
Distortion at high volume, Weak, "tinny" signal (Model 111 and 112 receivers)	1)	"shorted" condenser *No. 45*
	2)	"shorted" section in condenser *No. 49*
	3)	"short" in primary winding of input transformer and output transformer (indicated by "frying" noise)
Whistle on all stations (111 receiver)	1)	open-circuiting 0.05-mfd. grid filter condensers in the r-f and i.f stages
	2)	open-circuiting 0.05-mfd. plate filter condenser in first a-f stage
Distortion on local stations (112 receiver)	1)	replace the AVC resistor to the first r-f tube with a 70,000-ohm unit
	2)	check 5-watt carbon resistor between speaker return and ground for drift from original value of 15,000-ohms. If necessary to replace, use 5-watt wire-wound unit
Blocking, (similar to very slow recovery of AVC) Ringing sound in speaker when set is removed from cabinet (112 receiver)	1)	replace volume control
Crackling or sputtering at high volume	1)	breakdown of output transformer. Replace with new unit
Crackling noises	1)	burnt-out field coil. Replace with new unit
	2)	loose r-f or oscillator coil shields
Audio howl or whistle	1)	high-resistance connection in i-f or r-f coil, where leads are soldered to lugs
	2)	vibration of tin-enclosed by-pass condensers. Squeeze the tin covers so they will not vibrate
	3)	shorten wiring from pentode plates to speaker socket by running the wires *diagonally* past the i-f sensitivity switch and compensating condenser *No. 36*, taking care to dress wire away from condenser *No. 36* (this condition accented if output tubes are slightly unbalanced)
	4)	if input transformer has letter "A" after part number, connect a 0.0008-mfd. condenser across the entire secondary, if no letter follows the *part number* on bottom of transformer, connect a 490,000-ohm resistor across the entire secondary
Hum (in Model 111 and 112 receivers)	1)	"open" section in condenser *No. 49*

(Cont'd)

PHILCO 111, 111A, 112, 112A—*(Cont'd)*

Unable to cut volume down to zero (Model 111 and 112 receivers)	1)	"open" section in condenser *No. 49*

PHILCO 112X

Distortion, High-pitched whistle	1)	shorten pentode tube plate leads — run them diagonally across the chassis base to the plates (keep their polarity the same)
	2)	keep pentode plate leads free from 2nd i-f primary compensating condenser
Improving performance	1)	if input transformer has letter "A" after the part number on the terminal board, connect a 0.0008-mfd. condenser (Part *No. 5878*) *across the entire secondary* In later sets of this model (not using the letter "A") connect a 490,000-ohm resistor (Part *No. 4517*) across the secondary

PHILCO 116

Weak reception	1)	"leaky" condenser in plate-to-cathode circuit of oscillator tube
Fading	1)	check for high-resistance "leakage" between terminals of tube sockets (use ohmmeter for tests)
	2)	replace 4-condenser electrolytic by-pass unit (Part *No. 30-2121*)
Intermittent whistling over entire dial	1)	replace 10,000-ohm resistor (No. 96) in voltage divider section. To test, turn volume up full, tune off station and tap resistor. Listen for crackle
	2)	loosen i-f transformer shield. Spread mounting feet so good contact is made
Distortion at low volume	1)	try replacing 77 first detector
	2)	try replacing 77 first-audio tube
	3)	if the new tubes do not clear up the trouble, replace the volume control
Hum when volume is turned down low	1)	by-pass one side of a-c line to ground with a good-grade 0.1-mfd. paper or mica condenser

PHILCO 116-B (Code 121) and 116-X (Code 122)

Inoperative	1)	"shorted" condenser *No. 60* (indicated by resistor *No. 61* overheating)
	2)	"shorted" section in condenser *No. 47* (indicated by *narrow* tuning meter shadow)
	3)	"shorted" section in condenser *No. 47* or *No. 23* (indicated by *wide* tuning meter shadow)
	4)	"shorted" section in condenser *No. 80* (Code 121), or *No. 83* (Code 122)
	5)	"shorted" condenser *No. 83* (Code 121), or condenser *No. 90* (Code 122) (indicated by overheated rectifier tube)
	6)	"shorted" compensating condenser *No. 31*
	7)	"open" primary in input transformer
Intermittent reception	1)	"open" condenser *No. 86* (Code 121), or condenser *No. 85* (Code 122)—see *Note (A)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Intermittent reception (over portion or all of broadcast band)	1)	"open" oscillator transformer *No. 27*—see *Note (D)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

(Cont'd over)

PHILCO 116-B (Code 121) and 116-X (Code 122)—*(Cont'd)*

Reception cuts out after a minute or two of operation and shadowgraph shadow widens out	1)	"open" grid leak for the 77 first-detector stage. This is a 2-megohm unit mounted on a bracket in front of the 1st detector
Fading signal (retuning receiver brings fading station back)	1)	check for loose tuning dial set-screws
	2)	check for slipping tuning dial. Disassemble entire mechanism, clean thoroughly, then saturate internal sleeve with 3-in-1 oil or similar lubricant
	3)	replace i-f transformer *No. 52* with improved type
Weak, choked reception with normal shadowgraph action and no screen-grid voltage on first a-f tube	1)	"open" 1-meg. carbon resistor in the first a-f screen grid circuit
Weak reception	1)	if no "peak" can be obtained with padder *No. 21*, check for "shorted" condenser *No. 13*
Weak reception (intermittently)	1)	check compensating condensers *No. 48*, *51* and *57*—see *Note* (*L*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Whistling and only one or two powerful local stations received at *incorrect* points on dial	1)	"open" 2-mfd. r-f, i-f, or 1st detector screen-grid by-pass section, and a faulty 1-mfd. oscillator plate by-pass section
	2)	push "hot" grid lead on volume control close to chassis
Whistling or squealing	1)	if motorboating sound is also heard, check for "open" section in condenser *No. 80* (Code 121) or condenser *No. 83* (Code 122)
	2)	"open" condenser *No. 44*, *47* or *63*—see *Note* (*A*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Whistling or squealing and noise	1)	see *Note* (*M*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Motorboating sound, Whistling or squealing, Fading, Total inoperation (occasionally)	1)	loss in capacity or intermittent open circuits in sections of the 4-section electrolytic condenser block employed for by-passing various circuits. Check each section
Distortion at resonance peak of station	1)	check compensating condenser *No. 57*—see *Note* (*L*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	realign third i-f stage
Distortion at low volume	1)	"shorted" condenser *No. 86* (Code 121), or condenser *No. 85* (Code 122)
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 86* (Code 121), or condenser *No. 85* (Code 122)
	2)	"shorted" condenser *No. 90* (Code 121), or condenser *No. 83* (Code 121)
	3)	"shorted" section in condenser *No. 80* (Code 121)
	4)	"shorted" section in condenser *No. 83* (Code 122)
	5)	"shorted" primary in input transformer *No. 89* (Code 121), or *No. 92* (Code 122) (sometimes indicated by "frying" noise)

(Cont'd)

PHILCO 116-B (Code 121) and 116-X (Code 122)—*(Cont'd)*

Audio whistling or squealing	1)	relocate grid lead from 6A3 power tube near front of chassis so it runs over to, and parallel with, end of the chassis down as far as condenser *No. 85*, then over to input transformer
Hum (when volume is turned down low)	1)	by-pass one side of a-c line to ground with a good grade paper or mica 0.1-mfd. condenser
Hum	1)	high-resistance ground between pilot lamp wires and chassis
	2)	"open" condenser *No. 101* (Code 121), or *No. 103* (Code 122)
	3)	"shorted" condenser *No. 99* (Code 121), or *No. 102* (Code 122)
Noisy reception	1)	noisy type '6A3 tubes (even though they may test O.K.). Replace with new tubes by substitution
Vibration at high-frequency response	1)	weak spider. Replace speaker cone

PHILCO 118

Inoperative	1)	"shorted" condenser *No. 24* (indicated by *positive* voltage on oscillator control grid)
	2)	"shorted" condenser *No. 16* (indicated by *wide* tuning meter shadow)
	3)	"shorted" condenser *No. 46* (indicated by *narrow* tuning meter shadow)
	4)	"open" primary in input transformer *No. 54*
	5)	"shorted" condenser *No. 73* (indicated by overheated rectifier tube)
Intermittent reception	1)	faulty wave-band switch. Clean and adjust all contacts
	2)	intermittent "open" in 0.05-mfd. condenser connected to one lug of the volume control. Replace with Part *No. 30-4020*
	3)	"open" condenser *No. 41* or *No. 49*—see *Note* (*A*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	4)	"open" in i-f transformer *No. 81*—see *Note* (*B*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	5)	check for loose frequency-switch contacts
Intermittent drop in volume	1)	if accompanied by poor high-frequency response, check for intermittently "open" tone compensating condenser connected to volume control arm
	2)	intermittently "open" 0.05-mfd. avc filter condenser
Fading	1)	"gassy" '80 rectifier tube
	2)	if fading is due to slipping tuning dial, clean tuning condenser bearings and apply light oil. Oil pulley shaft carefully, keeping oil away from dial cable
	3)	if set fades after several minutes of playing, check 0.09-mfd. condenser in series with 1-megohm resistor from grid of 75 tube for partial "open"
Weak reception on short-waves	1)	"open" 0.003-mfd. condenser connected from band switch terminal to ground
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 46*
	2)	"shorted" primary in input transformer *No. 54* (indicated by "frying" noise)

(Cont'd)

PHILCO 118—*(Cont'd)*

Distortion at low volume, Shadowgraph action incorrect	1)	intermittent high-resistance leak in the 0.00018-mfd. mica plate coupling condenser connected between the type '78 tube plate and the type '6A7 tube grid. It is located inside the oscillator coil and its defect does not show up until some time after the receiver is in operation
Whistling or squealing	1)	if motorboating sound is also heard check for "open" condenser *No. 46*
	2)	"open" condenser *No. 16*
Hum	1)	"open" condenser *No. 73*
	2)	"shorted" condenser *No. 72*
R-F "hash"	1)	"open" section in dual filter condenser (Part *No. 30-2045*)
Vibration on certain notes	1)	loose escutcheon plate in resonance with these notes

PHILCO 118X

See also Case Histories listed for Philco 18X

No short-wave reception	1)	open-circuited 0.003-mfd. postage stamp type series condenser for this band
Intermittent reception, Two-spot tuning	1)	open-circuiting 0.05-mfd. grid-filter condenser in r-f stage
	2)	leaky or short-circuited grid-filter condenser in r-f stage
Shadowgraph does not function	1)	open-circuited shadowgraph
High-pitched reproduction	1)	open-circuited 10,000-ohm carbon resistor connected in series with 0.01-mfd. bypass condenser across plates of type '42 output tubes
Distortion, Glowing type '42 output tube grids	1)	push-pull input transformer secondary return "grounding" to core or shield. Insulate from chassis
Slipping dial drive	1)	insufficient tension of roller spring at end of drive shaft
Hum	1)	high-resistance ground on pilot-lamp wires
Noisy reception	1)	noisy type '6A3 tubes

PHILCO 144

Inoperative	1)	"shorted" section in condenser *No. 67* (indicated by overheated rectifier tube)
	2)	"shorted" condenser *No. 26, 55* or *59*
	3)	"shorted" section in condenser *No. 67* (indicated by *narrow* tuning meter shadow)
	4)	"shorted" section in condenser *No. 26* (indicated by *wide* tuning meter shadow and resistor *No. 65* overheating)
	5)	"shorted" condenser *No. 25* (Code 122 only) (indicated by *wide* tuning meter shadow)
	6)	"open" tuning meter *No. 43* (indicated by *narrow* tuning meter shadow)
	7)	"shorted" condenser *No. 42* (indicated by *narrow* tuning meter shadow)
	8)	"open" primary in output transformer *No. 60*
Inoperative on short-wave bands	1)	check for faulty contacts in waveband switch
Intermittent reception	1)	"open" condenser *No. 45* or *57*—see *Note* (*A*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	check i-f transformer *No. 28, 33* or *38*—see *Note* (*B*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

(Cont'd)

PHILCO 144—*(Cont'd)*

Shadowmeter shadow width varies in accordance with loud signals	1)	replace 3-section electrolytic condenser
Distortion at resonance peak of station	1)	partially "open" resistor *No. 50*
Distortion at low volume	1)	"shorted" condenser *No. 57*
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 55, 57* or *59*
Whistling or squealing	1)	"open" section in condenser *No. 26*
	2)	"open" condenser *No. 22, 40* or *42*—see *Note* (*A*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Hum	1)	"open" section in condenser *No. 67*
Aligning i-f circuits of receiver	1)	see Case History of this listed under Philco Model 44 receiver
Motorboating	1)	defective gang condenser. Replace with new unit
	2)	defective type '6A7 tube (even though it may test O.K.). Replace with new tube

PHILCO 144X

Same Case Histories as those listed for Philco 44

PHILCO 200, 200-X

Inoperative	1)	"shorted" condenser *No. 78* (indicated by overheated rectifier tube)
	2)	"shorted" section in condenser *No. 61*
	3)	"shorted" condenser *No. 37, 55* or *90*
	4)	"open" filter *No. 48*
	5)	"open" primary in input transformer *No. 57*
	6)	"open" choke *No. 82*
Intermittent reception	1)	"open" condenser *No. 53* or *No. 67*—see *Note* (*A*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Intermittently weak reception	1)	check compensating condenser *No. 20, 30* or *38*—see *Note* (*L*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"shorted" condenser *No. 37*
Distortion at low volume	1)	"shorted" condenser *No. 53*
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 53, 55* or *90*
	2)	"shorted" primary in input transformer No. 57 (indicated by "frying" noise)
Whistling or squealing	1)	"open" condenser *No. 61* (causing motorboating sound)
	2)	"open" condenser *No. 38*—see *Note* (*A*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Whistling and noise	1)	see *Note* (*M*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Hum	1)	"open" condenser *No. 78*
	2)	"shorted" condenser *No. 88*

(Cont'd over)

PHILCO 200, 200-X—*(Cont'd)*

Noise ("frying" or "popping")	1) 2)	replace noisy resistors *No. 7* and *No. 34* "open" filter *No. 48*
Vibration at high-frequency response	1)	weak speaker cone spider. Replace speaker cone
Rattle (similar to speaker rattle)	1)	resonant vibration of the metal sound diffuser mounted in front of the speaker. Bend the blades slightly until the rattle is eliminated

PHILCO 201

Inoperative	1) 2) 3) 4) 5) 6) 7)	"shorted" condenser *No. 101* (indicated by overheated rectifier tube) "shorted" condenser *No. 42, 78* or *77* "shorted" section in condenser *No. 29* or *103* "open" filter *No. 70* "open" primary in input transformer *No. 79* "shorted" condenser *No. 24* (indicated by *positive* voltage on oscillator control grid) "open" choke *No. 98* (sometimes indicated by "frying" noise)
Intermittent reception	1)	"open" condenser *No. 88*—see *Note* (*A*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Intermittently weak reception	1) 2)	check compensating condenser *No. 31, 46* or *57*—see *Note* (*L*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories "shorted" condenser *No. 42* or *No. 41*
Distortion at low volume	1)	"shorted" condenser *No. 73*
Distortion at high volume, Weak, "tinny" signal	1) 2)	"shorted" condenser *No. 73, 77* or *78* "shorted" primary in input transformer *No. 79* (sometimes indicated by "frying" noise)
Whistling or squealing	1) 2)	"open" condenser *No. 29* (causing motorboating sound) "open" section in condenser *No. 103*
Whistling and noise	1)	see *Note* (*M*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Vibration at high-frequency response	1)	replace speaker cone—weak spider
Hum	1) 2)	"open" condenser *No. 101* "shorted" condenser *No. 100*
Noise ("frying" or "popping")	1) 2)	replace noisy resistor *No. 11, 18, 19* or *89* "open" filter *No. 70*. Replace

PHILCO 211, 211A

Same Case Histories as those listed for Philco 111, 111A receivers

PHILCO 212, 212A

See also Case Histories listed for Philco 112 receiver

Inoperative, Weak	1)	check 15,000-ohm resistor between minus of speaker field and chassis for decrease in value. Replace with 5-watt unit

(Cont'd)

PHILCO 212, 212-A—*(Cont'd)*

Fading	1)	replace by-pass connected to "low" side of volume control. This is a tone compensator condenser for increasing bass response at low volume
Whistling and distortion when sensitivity switch is snapped to maximum	1)	"open" 0.5-mfd. condenser located in filter block by-passing screens of first detector and i-f

PHILCO 220, 220-A

Same Case Histories as those listed for Philco 20 receiver

PHILCO 270

Same Case Histories as those listed for Philco 70, 70A receivers

PHILCO 296-296A

See also Case Histories listed for Philco 95, 96, 96A receivers

Inoperative	1) 2)	check 250-ohm resistor in series with the screens of the three r-f tubes check the screen by-pass condensers
Weak reception, Intermittent fading	1)	check by-pass condensers (and their connecting leads) used in the r-f transformer secondary circuits. Bridge, one at a time, with a new 0.05-mfd. by-pass condenser until the faulty one is located
Whistling	1) 2) 2)	check the r-f by-pass condensers if the 70,000-ohm screen bleeder resistor becomes "open", the screen voltages will be above normal and oscillation will result connect two 0.5-mfd. by-pass condensers in series across r-f, detector and first a-f heater winding with the junction point grounded

PHILCO 370

Same Case Histories as those listed for Philco 70, 70A receivers

PHILCO 470

See also Case Histories listed for Philco 4 and Philco 70 receivers

No reception on second and third band	1)	poor switch contacts on wave-band switch
Intermittent reception, Hum (snapping power switch off and on restores set to normal operation)	1) 2)	short-circuited a-f coupling condenser. Replace with new unit "leaky" or intermittently opening 0.1-mfd. by-pass condenser from the plate of the '24A detector tube to ground

PHILCO 490

Same Case Histories as those listed for Philco 4 and Philco 90 receivers

PHILCO 500, 501

See also Case Histories listed for Philco 16, 16-X—(Code 124) receivers

Spasmodic phono reproduction	1)	poor contacts on the radio-phono transfer switch. Be careful not to bend the contact blades too far as they may lose their tension

PHILCO 503 (Code 122)

Same Case Histories as those listed for Philco 18 (Code 124) receiver

PHILCO 504

Same Case Histories as those listed for Philco 44 receiver

PHILCO 505

Same Case Histories as those listed for Philco 60 receiver

PHILCO 506

Same Case Histories as those listed for Philco 144 receiver

PHILCO 507

Same Case Histories as those listed for Philco 118 receiver

PHILCO 509

Same Case Histories as those listed for Philco 201 receiver

PHILCO 511, 512, 513, 514, 515, 521, 531

Inoperative	1)	"open" section in resistor *No. 37*
	2)	"shorted" section in condenser *No. 35* (indicated by overheated rectifier tube)
	3)	"shorted" condenser *No. 7, 12, 17* or *27*
	4)	"open" primary in a-f transformer *No. 22* or *No. 25*
	5)	"open" tone filter *No. 26*
	6)	"grounded" or "open" circuit in pick-up jack
	7)	"shorted" section in condenser *No. 35*
Weak reception	1)	check range control switch *No. 4* for "open" contact (indicated by hum)
Distortion at high volume, Weak, "tinny" signal	1)	"open" section in resistor *No. 37*
	2)	"shorted" primary in a-f transformer *No. 22* or *No. 25* (indicated by "frying" noise)
	3)	"grounded" pilot lamp terminal at top of bracket
	4)	check speaker unit
Distortion, Hum	1)	"shorted" condenser *No. 30* (indicated by loud hum)
	2)	"grounded" hum potentiometer *No. 31* or *No. 32* (indicated by loud hum)
	3)	"grounded" filament bus lines (indicated by loud hum)
Hum	1)	"open" section in condenser *No. 35*
	2)	faulty '80 tube
	3)	faulty detector tube
	4)	place a shield over detector tube. Ground shield to chassis
Whistling or squealing	1)	"open" condenser *No. 7, 12, 17* or *30*
	2)	dress lead from volume control arm to antenna coil primary as far away as possible from padders
	3)	tighten padder *No. 9* about ¼ turn from its resonance peak
"Shaky" reproduction	1)	check for partial "open" in voltage divider section feeding the r-f plate
Poor tone quality (in Model 531 receiver)	1)	if poor tone quality is due to the speaker, replace it with an a-c dynamic speaker. Change the '71 tube to a '45 by wiring the filament terminals directly to the '27 socket. Then bias the tube with a 1500-ohm 5-watt resistor and by-pass this with a 10-mfd. 50-volt condenser. Remove the condenser which couples the tube to the old magnetic speaker, and discard it. Then run the leads from the output transformer to the highest voltage in the set and then directly to the plate of the '45

PHILCO 551

Same Case Histories as listed for Philco 51 receiver

PHILCO 570 (Grandfather Clock)

Same Case Histories as those listed for Philco 70, 70A receivers

PHILCO 600

Inoperative	1)	"open" field coil *No. 34*
	2)	"open" primary in output transformer *No. 32*
	3)	"shorted" section in condenser *No. 38* (indicated by overheated rectifier tube)
	4)	"shorted" condenser *No. 10* or *No. 31*
Inoperative, Intermittent reception	1)	"open" or "grounded" grid winding in oscillator transformer *No. 14* (at base of coil-form usually)
	2)	"open" condenser *No. 27*—see *Note* (*A*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Fading	1)	"leaky" twin 0.09-mfd. bakelite-housed condenser by-passing screens of the 6A7 mixer and 77 detector tubes. Replace with two 0.1-mfd. 400-volt units
Distortion at low volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 27*
Whistling or squealing	1)	"open" condenser *No. 10* or *No. 38*
Hum	1)	"open" section in condenser *No. 38*

PHILCO 600C

Inoperative	1)	check for broken lead to oscillator coil. Replace it
Intermittent reception, Noise	1)	bad connections on antenna and oscillator coils. Resolder
Poor tone	1)	connect a 25-mfd., 50-volt electrolytic condenser between the ground and the center-tap of the power transformer high-voltage secondary. Shunt this across the present condensers in that circuit

PHILCO 602

Inoperative	1)	"open" field coil *No. 51*
	2)	"open" primary in output transformer *No. 49*
	3)	"shorted" section in condenser *No. 12* or *No. 13*
Inoperative, Intermittent reception	1)	"open" or "grounded" grid winding in oscillator transformer *No. 5*
	2)	"open" section in condenser *No. 12*—see *Note* (*A*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Weak operation (all plate voltages low)	1)	"open" section in condenser *No. 13*
Distortion	1)	"leakage" or "shorted" section in condenser *No. 13*

(Cont'd over)

PHILCO 602—*(Cont'd)*

Distortion at low volume, Weak, "tinny" signal	1)	"shorted" section in condenser *No. 12*
Whistling or squealing	1)	"open" condenser *No. 13* or *No. 12*
Hum	1)	ground the tap between the speaker voice coil and the hum-bucking coil
	2)	"open" condenser *No. 12* or *No. 13*

PHILCO 602C

Inoperative	1)	"shorted" trimmer on oscillator tuning condenser

PHILCO 604

Inoperative	1)	"shorted" condenser *No. 61*
	2)	"open" field coil *No. 58*
	3)	"open" primary in output transformer
	4)	"shorted" section in condenser *No. 54*
	5)	"shorted" section in condenser *No. 31*
Inoperative (on broadcast band only)	1)	"shorted" compensating condenser *No. 10* or *No. 11*
	2)	"grounded" or "open" grid winding in oscillator transformer *No. 7*
Weak operation (all plate voltages low)	1)	"open" section in condenser *No. 54*
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 51*
	2)	"shorted" section in condenser *No. 50*
Distortion	1)	"leakage" or "shorted" section in condenser *No. 54*
Whistling or squealing, Motorboating sound	1)	"open" condenser *No. 54* (causing motorboating sound)
	2)	"open" section in condenser *No. 30* or *No. 31*
Hum	1)	"open" section in condenser *No. 54*

PHILCO 608 Radio-Phono (Early Models)

See also Case Histories listed for Philco 609 Radio-Phono

To improve tone quality of phono section	1)	change resistor *No. 47* from 470,000 to 330,000 ohms. Change condenser *No. 58* from 0.001 to 0.002-mfd. Remove condenser *No. 44*, and connect switch contact C9A to the junction between condenser *No. 46* and resistor *No. 45*. Connect a 0.004-mfd. condenser between switch contact C10A and the condenser *No. 58* and the volume control. Remove condenser *No. 38*, and wire switch contacts C8A to the point where resistors *40C* and *39* are connected

PHILCO 609 Radio-Phono

Phono reproduction lacks volume and bass	1)	adjust phono light beam control padder for best tone, volume and brilliance of light beam. Padder is located on top of chassis, near tuning condenser
Phono reproduction "fuzzy"	1)	adjust position of light beam on the photoelectric cell. The beam should be vertical, with half of the light on the cell and the other half on the border of the cell. Adjustment is located on the side of the pickup

PHILCO 610

See also Case Histories listed for Philco 609 Radio-Phono

Inoperative	1)	"open" resistor *No. 42*
	2)	"open" primary in output transformer
	3)	"shorted" condenser *No. 15*, *47* or *51*
	4)	"shorted" condenser *No. 23*—indicated by resistor *No. 24* overheating (in early runs only)
Inoperative, Intermittent reception (over portion, or all, of broadcast band)	1)	"open" circuit in oscillator transformer *No. 8*. Check for dampness, or loose connection at top of coil
Intermittent reception	1)	"open" condenser *No. 45*—see *Note (A)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	check for loose connection on rectifier socket
Fading at low-frequency end of broadcast band	1)	leakage in padding condenser for the broadcast band. Remove the condenser, clean it in carbon tetrachloride
Improving oscillator action at 6.0 mc.	1)	in receivers made previous to Run 15, remove 51,000-ohm resistor No. 17 and 25,000-ohm resistor No. 18. A 32,000-ohm resistor (Part *No. 33-332133*) should be added from the switch terminal side of condenser No. 7 to ground. A 20-ohm resistor (Part No. *33-020133*) should be connected between 6A7 cathode and ground
Intermittent whistling or squealing, Noisy reception (upon slightest jar of the cabinet or chassis)	1)	poorly grounded coil shields, or loose grounding lug on the tube sockets. Spread the spaded clamps on the coil shields so positive contact is secured
Whistling or squealing (steadily)	1)	"open" condenser *No. 25* (in early-run receivers only)
	2)	"open" condenser *No. 15*
Whistling or squealing (accompanied by noise)	1)	check first i-f transformer for high-resistance "short"
	2)	see *Note (M)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Whistling or squealing whenever volume control is touched	1)	check 41 output plate condenser for "open." This condenser is connected in series with tone control condenser, and is located in tone control housing
Whistling or squealing (decreases in intensity when tone control is on full)	1)	replace volume control
Audio howling or whistling	1)	make sure control grid to 75 tube is inside of tube shield
	2)	dress wiring to plate and grid of output tube away from plate and grid wiring of 75 tube
	3)	remove lead to tone control from its connection at the socket of output tube and connect it to the speaker cable plate lead at the rear of chassis

(Cont'd)

PHILCO 610—*(Cont'd)*

Distortion	1)	faulty 0.015-mfd. coupling condenser between the 75 detector plate and the grid of the 42 tubes. The condenser used in this position should have a terminal resistance of over 100 megohms (when tested on a voltage of not less than 400 volts). Replace it if its resistance is less than this. Use a 600-volt unit
	2)	check 0.1-mfd. condenser No. 47 at intersection of two 100,000-ohm resistors in second detector plate circuit. Realign all circuits
	3)	if tone is "mushy" and 42 screen voltage is nearly equal to, or higher than plate voltage, connect a 2,000 or 3,000-ohm resistor in series with screen lead
Distortion at resonance peak of station	1)	"partial open" resistor *No. 57*
	2)	"shorted" secondary in i-f transformer *No. 27*
	3)	realign second i-f stage
Distortion at low volume	1)	"shorted" condenser *No. 45*
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 45* or *No. 47*
	2)	"shorted" section in condenser *No. 51*

PHILCO 611

See also Case Histories listed for Philco 609 Radio-Phono

Inoperative	1)	replace filter condenser and 78 i-f screen grid resistor
	2)	check oscillator padding condenser (Part *No. 60-3027*) for "leakage". Replace
	3)	"open" resistor *No. 41*
	4)	"shorted" condenser *No. 21, 49* or *63*
	5)	"shorted" condenser *No. 27* (indicated by resistor *No. 26* burning)
	6)	"open" field coil *No. 53*
	7)	"open" primary in output transformer *No. 51*
Inoperative, Intermittent reception (over portion, or all, of broadcast band)	1)	"open" oscillator transformer *No. 11*
Distortion at resonance peak of station	1)	realign second i-f stage
	2)	"shorted" secondary in i-f transformer *No. 30*
Distortion at low volume	1)	"shorted" condenser *No. 45* or *No. 37*
Hum	1)	"open" section in condenser *No. 49*
Whistling or squealing accompanied by noise	1)	see *Note (M)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Whistling or squealing	1)	"open" condenser *No. 21, 22* or *49*
Audio howling or whistling	1)	refer to Case History listed for this trouble symptom in Philco 610 receiver

PHILCO 611-J

Cross-talk at 1,010-1,500 kc	1)	replace 6A8G tube with a 6A8. Align receiver. Install shielded wave trap if necessary

PHILCO 616-P

Same Case Histories as listed for Philco 609 Radio-Phono

PHILCO 620

Inoperative	1)	check condenser which by-passes plate supply of 75 second detector. Unit is bakelite encased, one lead being connected to junction of 70,000 and 99,000-ohm resistors, other lead to chassis through screw holding unit to chassis. Use 0.1-mfd. for replacement
	2)	"open" field coil *No. 64*
	3)	"shorted" section in condenser *No. 67* (indicated by overheated rectifier tube)
	4)	"shorted" condenser *No. 61A, 51* or *57*
	5)	"open" primary in output transformer *No. 62*
	6)	"shorted" 0.02-mfd. by-pass condenser connected between 42 tube plate and chassis
Inoperative, Intermittent reception over portion or all of broadcast band	1)	see *Note (D)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" oscillator transformer *No. 11*
Inoperative (only loud hum heard)	1)	replace 8-mfd. filter condenser connected from 80 tube filament to transformer secondary center tap
Fading at low-frequency end of broadcast band	1)	same Case History as that listed for this trouble symptom under Philco 610 receiver
Whistling or squealing (intermittently), Noisy reception	1)	"open" condenser *No. 23A* or *No. 23*
	2)	poorly grounded coil shields. Spread spaded clamps or shields so "positive" contact is obtained
	3)	loose grounding lug on tube sockets
	4)	"ground" the 6A7 control grid temporarily. If noise stops, check for faulty primary of 78 r-f coil
	5)	see *Note (M)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Audio howling or whistling	1)	see Case History for this trouble symptom listed for Philco 610 receiver
Distortion at resonance peak of station	1)	"partial open" resistor *No. 70*
	2)	"shorted" secondary in i-f transformer *No. 37*
	3)	"shorted" condenser *No. 23* or *No. 23A*
	4)	"grounded" secondary in antenna transformer *No. 3* (in some runs only)
Distortion at low volume	1)	"shorted" condenser *No. 59*
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 57* or *No. 59*
Hum	1)	"open" section in condenser *No. 67*

PHILCO 623

See also Case Histories listed for Philco 609 Radio-Phono

Inoperative	1)	"open" primary in input transformer *No. 42* and output transformer *No. 44*
	2)	"shorted" section in condenser *No. 21*
	3)	"shorted" condenser *No. 26*
	4)	"grounded" compensating condenser *No. 11*
Inoperative, Intermittent reception over portion or all of broadcast band	1)	"open" or damp windings in oscillator transformer *No. 10*

(Cont'd over)

PHILCO 623—*(Cont'd)*

Intermittent reception	1)	"open" condenser *No. 34* or *No. 39*
Inoperative over high-frequency portion of dial	1)	replace 1C6 oscillator tube with a 1A6 tube
	2)	replace oscillator coil
Weak reception	1)	replace '30 second detector tube even if original tube checks O.K.
	2)	ground the '34 grid through a 1-megohm resistor
	3)	"shorted" condenser *No. 30*
	4)	to increase sensitivity of receiver replace 1st i-f transformer (Part *No. 32-1793*) with new type (Part *No. 32-1671*)
Dial readings off about 50 kc., Weak reception, Distortion	1)	look for metal filings or other foreign material in oscillator low-frequency compensator. This part (No. 14) is located near volume control
Distortion at resonance peak of station	1)	realign 2nd i-f stage
	2)	"shorted" condenser *No. 18*
	3)	"shorted" secondary in i-f transformer *No. 28*
Distortion at low volume	1)	"shorted" condenser *No. 39*
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 39*
	2)	"shorted" primary in input transformer *No. 42* and output transformer *No. 44*
Whistling or squealing	1)	"open" condenser *No. 21* or *No. 26*
	2)	check for low battery voltages
Whistling or squealing and noisy reception	1)	see *Note (M)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

PHILCO 624 Battery Set

Inoperative	1)	vibrator *No. 44* inoperative
	2)	"shorted" section in condenser *No. 50* (indicated by burned vibrator armature)
	3)	"open" primary in input transformer *No. 69* and output transformer *No. 72*
	4)	"shorted" condenser *No. 22* (indicated by resistor *No. 23* overheating)
	5)	"shorted" condenser *No. 50* (indicated by choke *No. 51* overheating)
	6)	"shorted" section in condenser *No. 58* (indicated by resistor *No. 59* overheating)
	7)	"shorted" condenser *No. 74* (indicated by choke *No. 53* overheating)
Inoperative, Intermittent reception over portion or all of broadcast band	1)	damp or "open" oscillator transformer *No. 13*
Intermittent reception	1)	"open" condenser *No. 36* or *No. 65*
Distortion at low volume	1)	"shorted" condenser *No. 65*
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" primary in input transformer *No. 69*
Whistling or squealing	1)	"open" condenser *No. 20* or *No. 21*
	2)	"open" condenser *No. 22, 52* or *58*
Whistling and noise	1)	see *Note (M)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

(Cont'd)

PHILCO 624 Battery Set—*(Cont'd)*

Hum	1)	extension cable in "A" lead too light. Use heavier cable
	2)	low "A" battery
	3)	poor ground connection to "B"-power unit
	4)	"open" section in condenser *No. 58*
Vibrator hash	1)	low "A" battery
	2)	filament wires in receiver too close to the audio, i-f, or r-f leads. Separate the filament leads as much as possible from all other leads
	3)	customer may have extended length of battery leads. These should not be of greater length than those supplied with the receiver

PHILCO 625

See also Case Histories listed for Philco 609 Radio-Phono

Inoperative	1)	"shorted" condenser *No. 51, 57* or *61A*
	2)	"shorted" section in condenser *No. 67* (indicated by overheated rectifier tube)
	3)	"shorted" condenser *No. 67A* (indicated by resistor *No. 70* overheating)
	4)	"open" primary in output transformer *No. 62*
	5)	"open" field coil *No. 64*
	6)	"shorted" 0.02-mfd. by-pass condenser connected from 42 tube plate to chassis
Inoperative on broadcast band (reception O.K. on short-wave bands)	1)	check r-f transformer for loose connection
Inoperative, Intermittent reception over portion or all of broadcast band	1)	see *Note (D)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" oscillator transformer *No. 11*
Fading at the low-frequency end of the broadcast band	1)	leakage in padding condenser for the broadcast band. Remove the condenser, clean it in carbon tetrachloride
Whistling or squealing, Noisy reception (upon slightest jar of the cabinet or chassis)	1)	poorly grounded coil shield, or loose grounding lug rivets on the tube sockets. Spread the spaded clamps on the coil shields so positive contact is made
	2)	"open" condenser *No. 23* or *No. 23A*
	3)	"open" section in condenser *No. 67*
	4)	see *Note (M)* listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Audio howling or whistling	1)	see Case History for this trouble listed for Philco 610 receiver
Distortion at resonance peak of station	1)	"shorted" condenser *No. 23* or *No. 23A*
	2)	"grounded" secondary antenna transformer *No. 3*
	3)	"partial open" resistor *No. 70*
	4)	realign second i-f transformer
Distortion at low volume	1)	"shorted" condenser *No. 59*
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 57* or *No. 59*
Hum	1)	"open" section in condenser *No. 67*

PHILCO 629-P

Same Case Histories as listed for Philco 609 Radio-Phono

PHILCO 630

Inoperative	1)	"open" field coil *No. 64*
	2)	"open" primary in output transformer *No. 62*
	3)	"shorted" section in condenser *No. 67* (indicated by overheated rectifier tube)
	4)	"open" tuning meter *No. 55*—indicated by *narrow* tuning meter shadow (in some runs only)
	5)	"shorted" condenser *No. 66* (indicated by *wide* tuning meter shadow)
	6)	"shorted" condenser *No. 51* or *No. 59C*
	7)	"shorted" 0.02-mfd. by-pass condenser connected from 42 tube plate to chassis
Inoperative, Intermittent reception over portion or all of broadcast band	1)	see *Note* (*D*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" oscillator transformer *No. 11*
Fading at the low-frequency end of the broadcast band	1)	leakage in padding condenser for the broadcast band. Remove the condenser, clean it in carbon tetrachloride
Whistling or squealing, Noisy reception (upon slightest jar of the cabinet or chassis)	1)	poorly grounded coil shields, or loose grounding lug rivets on the tube sockets. Spread the spaded clamps on the coil shields so positive contact is made
	2)	see *Note* (*M*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	3)	see Case Histories listed for this trouble symptom in Philco 620 receiver
High-pitched whistles, then goes dead	1)	if turning set on and off brings back reception, check for intermittent breakdown in tone control condenser
High-pitched whistle or howl with volume control turned about ¾ way up		if this disappears for all other settings of volume control, check for "open" condenser No. 61A (Part No. *30-4042*) connected from 42 tube plate to B-minus
Whistling or squealing at high settings of volume and tone controls	1)	dress 75 tube control grid lead away from 42 power tube—keep it near i-f tube side
Audio howling or whistling	1)	see Case Histories listed for this trouble symptom under Philco 610 receiver
Distortion	1)	leaky 0.1-mfd. second detector plate by-pass condenser. In some runs, the capacity of this condenser is 0.09-mfd. However, a 0.1-mfd. replacement may be used
Distortion at resonance peak of station	1)	realign second i-f stage
	2)	"partially open" resistor *No. 70*
	3)	"grounded" secondary in antenna transformer *No. 3*
	4)	"shorted" condenser *No. 23* or *No. 23A*
	5)	"shorted" secondary in i-f transformer *No. 37*
Distortion at low volume	1)	"shorted" condenser *No. 59*
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 59* or *No. 59C*
Hum	1)	improperly connected hum-bucking coil on dynamic speaker. Reverse either the voice coil or the hum-bucking coil leads
	2)	"open" section in condenser *No. 67*

PHILCO 635

Inoperative	1)	"open" field coil *No. 64*
	2)	"shorted" condenser *No. 51, 59C* or *61A*
	3)	"open" tuning meter *No. 55* (indicated by *narrow* tuning meter shadow)
	4)	"shorted" condenser *No. 66* (indicated by *wide* tuning meter shadow)
	5)	"shorted" condenser *No. 56* (indicated by *narrow* tuning meter shadow, and by resistor *No. 57* burning)
	6)	"shorted" condenser *No. 67* (indicated by overheated rectifier tube)
Inoperative, Intermittent reception over portion or all of broadcast band	1)	see *Note* (*D*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" oscillator transformer *No. 11*
Fading at the low-frequency end of the broadcast band	1)	leakage in padding condenser for the broadcast band. Remove the condenser, clean it in carbon tetrachloride
Whistling or squealing, Noisy reception (upon slightest jarring of the cabinet or chassis)	1)	poorly grounded coil shields, or loose grounding lug rivets on the tube sockets. Spread the spaded clamps on the coil shields so positive contact is made
	2)	"open" condenser *No. 23* or *No. 23A*
	3)	"open" section in condenser *No. 56*
	4)	see *Note* (*M*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	5)	make sure that 75 tube control grid lead is inside tube shield
Whistling or squealing at high settings of volume and tone controls	1)	keep control grid lead of 75 tube away from 42 power tube. Keep it near the i-f tube side
Tube replacement note	1)	when replacing tubes in this receiver, be sure the grid cap lead of the 75 tube is *inside* the tube shield; otherwise "birdies" will be present at one setting of the volume control
Audio howling or whistling	1)	see Case Histories listed for this trouble symptom in Philco 610 receiver
Distortion at resonance peak of station	1)	"shorted" condenser *No. 23* or *No. 23A*
	2)	"grounded" secondary in antenna transformer *No. 3*
	3)	"partial open" resistor *No. 70*
	4)	realign 2nd i-f stage
Distortion at low volume	1)	"shorted" condenser *No. 59*
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 59* or *No. 59C*
Hum	1)	"open" section in condenser *No. 67*

PHILCO 640

Inoperative	1)	"open" primary in a-f transformer *No. 69*
	2)	"shorted" condenser *No. 19* or *No. 18* (indicated by *wide* tuning meter shadow)
	3)	"inter-winding short" in r-f transformer *No. 11* (indicated by *wide* tuning meter shadow)—see *Note* (*E*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	4)	"shorted" condenser *No. 32*
	5)	"shorted" section in condenser *No. 68*
	6)	"shorted" condenser *No. 44* (indicated by resistor *No. 43* burning)

(Cont'd over)

PHILCO 640—*(Cont'd)*

Inoperative, Intermittent reception over portion or all of broadcast band	1)	see *Note* (*D*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" oscillator transformer *No. 20*
Distortion at resonance peak of station	1)	realign second i-f stage
	2)	"shorted" secondary in i-f transformer *No. 47*
	3)	"shorted" condenser *No. 85*
Distortion at low volume	1)	"open" or "shorted" a-f transformer *No. 69*
	2)	"shorted" primary in coupling condenser (incorporated in transformer unit)
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" primary in a-f transformer *No. 69*
	2)	"shorted" section in condenser *No. 68*
Whistling or squealing	1)	"open" condenser *No. 32, 42* or *85*
	2)	"open" condenser *No. 68* (causing motorboating sound)
Whistling and noise	1)	see *Note* (*M*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Microphonic	1)	replace i-f transformer *No. 39* with new type

PHILCO 641 D-C

Inoperative	1)	"open" primary in a-f transformer *No. 75*
	2)	"inter-winding short" in r-f transformer *No. 12* (indicated by *wide* tuning meter shadow)—see *Note* (*E*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	3)	"open" tuning meter *No. 37* (indicated by *narrow* tuning meter shadow)
	4)	"shorted" condenser *No. 10* (indicated by choke *No. 74* overheating)
	5)	"shorted" condenser *No. 30* (indicated by choke *No. 73* and resistor *No. 26* overheating)
	6)	"shorted" condenser *No. 67* (indicated by resistors *No. 68* and *No. 69* overheating)
	7)	"shorted" condenser *No. 21* or *No. 57*
Inoperative, Intermittent reception over portion or all of broadcast band	1)	see *Note* (*D*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" oscillator *No. 20*
Distortion at resonance peak of station	1)	realign second i-f stage
	2)	"shorted" condenser *No. 7* or *No. 16*
Distortion at low volume	1)	"shorted" condenser *No. 52*
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 52* or *No. 65*
	2)	"shorted" primary in a-f transformer *No. 75*
Whistling or squealing	1)	"open" condenser *No. 10* or *No. 30*
Whistling and noise	1)	see *Note* (*M*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

PHILCO 642 (32 Volt D-C)

Inoperative	1)	"open" primary in input transformer *No. 58* and output transformer *No. 59*
	2)	"inter-winding short" in r-f transformer *No. 7*—see *Note* (*E*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	3)	"shorted" condenser *No. 30* (indicated by resistor *No. 48* burning)
	4)	"shorted" condenser *No. 29*
Inoperative, Intermittent reception over portion or all of broadcast band	1)	see *Note* (*D*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" oscillator transformer *No. 11*
Distortion at resonance peak of station	1)	realign second i-f stage
	2)	"shorted" condenser *No. 23* or *No. 19*
Distortion at low volume	1)	"partially open" secondary in a-f transformer *No. 58*
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" primary in input transformer *No. 58* and output transformer *No. 59*
Whistling and noise	1)	see *Note* (*M*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Hum	1)	"open" condenser *No. 30*

PHILCO 643

Inoperative	1)	"open" primary in input transformer *No. 68* and output transformer *No. 69*
	2)	"inter-winding short" in r-f transformer *No. 16*—see *Note* (*E*) listed under Philco Receiver General Servicing Data" at beginning of Philco case histories
	3)	"shorted" condenser *No. 33, 37, 38, 42, 63* or *9*
Weak reception (all voltages check O.K.)	1)	replace output transformer
Inoperative, Intermittent reception over portion or all of broadcast band	1)	see *Note* (*D*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" oscillator transformer *No. 27*
Distortion at resonance peak of station	1)	realign second i-f stage
	2)	"shorted" condenser *No. 11* or *No. 21*
Distortion at low volume	1)	"shorted" condenser *No. 67*
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 67*
	2)	"shorted" primary in input transformer *No. 68* and output transformer *No. 69*
Whistling or squealing	1)	"open" condenser *No. 9* or *No. 42*
	2)	"open" section in condenser *No. 37*
	3)	check for low battery voltages
Whistling and noise	1)	see *Note* (*M*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories

PHILCO 645

Inoperative	1)	"open" primary in input transformer *No. 52*
	2)	"shorted" condenser *No. 7*
	3)	"shorted" section in condenser *No. 51*

(Cont'd)

PHILCO 645—*(Cont'd)*

Inoperative —*(Cont'd)*	4)	"shorted" condenser *No. 15* (indicated by *wide* tuning meter shadow)
	5)	"inter-winding short" in r-f transformer *No. 10* (indicated by *wide* tuning meter shadow)—see *Note* (*E*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	6)	"open" tuning meter *No. 71* (indicated by *narrow* tuning meter shadow)
	7)	"shorted" compensating condenser *No. 24*
Inoperative on short-wave band	1)	"shorted" oscillator transformer *No. 21*
Inoperative, Intermittent reception over portion or all of broadcast band	1)	see *Note* (*D*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" oscillator transformer *No. 21*
Distortion at resonance peak of station	1)	realign second i-f stage
	2)	"shorted" secondary in i-f transformer *No. 32*
Distortion at low volume	1)	check a-f transformer *No. 52* ("shorted" primary coupling condenser)
	2)	"shorted" condenser *No. 50*
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" primary in a-f transformer *No. 52*
	2)	"shorted" section in condenser *No. 51*
	3)	"shorted" condenser *No. 50*
Whistling or squealing	1)	"open" condenser *No. 79*, *9* or *7*
	2)	"open" condenser *No. 76* (causing motorboating sound)
Whistling and noise	1)	see *Note* (*M*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Hum	1)	reverse the *green* and *yellow* leads to the primary of the input transformer

PHILCO 650

Inoperative	1)	"open" field coil *No. 70*
	2)	"open" primary in input transformer *No. 67*
	3)	"shorted" condenser *No. 44* (indicated by resistor *No. 43* burning)
	4)	"shorted" section in condenser *No. 77* (indicated by overheated rectifier tube)
	5)	"shorted" condenser *No. 18* or *No. 19* (indicated by *wide* tuning meter shadow)
	6)	"inter-winding short" in r-f transformer *No. 11* (indicated by *wide* tuning meter shadow)—see *Note* (*E*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	7)	"shorted" section in condenser *No. 51A* or *No. 71*
	8)	"shorted" condenser *No. 59*
	9)	"shorted" compensating condenser *No. 26*
	10)	"grounded" resistor *No. 72*
Inoperative when set is first turned on —then operates O.K.	1)	check for "leaky" condenser *No. 71A* in 6A7 screen circuit

(Cont'd)

PHILCO 650—*(Cont'd)*

Inoperative, Intermittent reception over portion or all of broadcast band	1)	see *Note* (*D*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" oscillator transformer *No. 20*
Weak, distorted reception	1)	replace condenser (Part *No. 3615-SU*) connected to control grid on one of 42 tubes
Distortion at resonance when strong signals are being received	1)	insufficient AVC voltage to i-f 78 tube Remove the 0.5-meg. carbon resistor connected from the i-f secondary return to ground or chassis. This nut is located near the first i-f transformer
	2)	realign second i-f stage
	3)	"shorted" secondary in i-f transformer *No. 47*
	4)	"shorted" condenser *No. 30* or *No. 85*
Distortion at low volume	1)	"shorted" condenser *No. 63*
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 59*
	2)	"shorted" primary in input transformer *No. 67*
Hum	1)	"open" section in condenser *No. 77*
	2)	"shorted" condenser *No. 80*
Whistling or squealing	1)	"open" condenser *No. 85*, *80* or *81A*
	2)	"open" condenser *No. 71* (causing motorboating sound)
Whistling and noise	1)	see *Note* (*M*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Erratic volume control	1)	connect a 0.00005-mfd. condenser between the tap of the control and ground

PHILCO 650X

Inoperative	1)	6K5 tube dead. A 6F5 tube may be used to replace it for temporary replacement by connecting pins 3 and 4 at the socket
Intermittent operation	1)	faulty phono-radio transfer switch. There will be lack of screen grid voltage on the r-f and i-f tubes
Intermittent operation on broadcast.O.K. on short-waves	1)	open 6A8 grid coil where lead goes to band switch

PHILCO 651

Inoperative	1)	"open" primary in a-f transformer *No. 81*
	2)	"inter-winding short" in r-f transformer *No. 14* (indicated by wide tuning meter shadow)—see *Note* (*E*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	3)	"open" tuning meter *No. 44* (indicated by *narrow* tuning meter shadow)
	4)	"shorted" condenser *No. 15* (indicated by *wide* tuning meter shadow)
	5)	"shorted" section in condenser *No. 47*, *77* or *79*
Inoperative, Intermittent reception over portion or all of broadcast band	1)	see *Note* (*D*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" oscillator transformer *No. 15A*
Distortion at resonance peak of station	1)	realign second i-f stage

(Cont'd over)

PHILCO 651—*(Cont'd)*

Distortion at low volume	1)	"shorted" condenser *No. 72*
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" section in condenser *No. 77* or *No. 79*
	2)	"shorted" condenser *No. 72*
	3)	"shorted" primary in a-f transformer *No. 81*
Whistling or squealing	1)	separate *No. 1* i-f transformer leads from *No. 2* i-f transformer leads as far as possible
	2)	"open" section in condenser *No. 25, 47* or *99*
Whistling and noise	1)	see *Note* (*M*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Hum	1)	"open" section in condenser *No. 77*
Motorboating sound	1)	move B-lead from suppressor plate terminal to the wiring panel mounted on condenser *No. 72* away from wave trap coil and as close to the sub-base as possible

PHILCO 655

Inoperative	1)	"shorted" compensating condenser *No. 22*
	2)	"shorted" condenser *No. 7* or *No. 46*
	3)	"shorted" section in condenser *No. 70*
	4)	"shorted" section in condenser *No. 58* (indicated by overheated rectifier tube)
	5)	"shorted" condenser *No. 8* (indicated by *wide* tuning meter shadow)
	6)	"inter-winding short" in r-f transformer *No. 10* (indicated by *wide* tuning meter shadow)—see *Note* (*E*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	7)	"open" tuning meter *No. 73* (indicated by *narrow* tuning meter shadow)
	8)	"grounded" resistor *No. 56*
	9)	"open" primary in input transformer *No. 51*
	10)	"open" field coil
Inoperative, Intermittent reception over portion or all of broadcast band	1)	see *Note* (*D*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" oscillator transformer *No. 16*
	3)	"shorted" grid condensers
Distortion at resonance peak of station	1)	"shorted" secondary in i-f transformer *No. 30*
	2)	realign second i-f stage
Distortion at low volume	1)	"shorted" condenser *No. 49*
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 46*
	2)	"shorted" primary in input transformer *No. 51*
Whistling or squealing	1)	"open" condenser *No. 79, 76,* or *7*
Whistling and noise	1)	see *Note* (*M*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Hum	1)	"open" section in condenser *No. 58*
	2)	"shorted" condenser *No. 59*
Motorboating sound	1)	"open" condenser *No. 70*

(Cont'd)

PHILCO 655—*(Cont'd)*

Improving performance (receivers made prior to Run 2)	1)	remove 51,000-ohm resistor No. 14 (Part *No. 33-351143*). Connect a 32,000-ohm ½-watt resistor (Part *No. 33-332334*) from the oscillator grid of the 6A7 tube to the suppressor grid of the 78 r-f amplifier tube
Slipping dial	1)	back celluloid disc binds behind the dial face. Disassemble the dial, remove the black disc and ream out its inside circumference slightly, so that undue friction against the dial collar is not present

PHILCO 660

Inoperative	1)	"shorted" section in condenser *No. 82*
	2)	"shorted" condenser *No. 71, 93* or *94*
	3)	"shorted" section in condenser *No. 86* (indicated by overheated rectifier tube)
	4)	"shorted" condenser *No. 19* (indicated by *wide* tuning meter shadow)
	5)	"shorted" condenser *No. 39* or *59* (indicated by *narrow* tuning meter shadow)
	6)	"open" primary in input transformer *No. 74*
Inoperative, or weak, on broadcast band	1)	if this is accompanied by "hiss," check the r-f choke mounted on the front waveband switch section shield for an open-circuited condition—examine especially for breaks at the lugs
	2)	see *Note* (*D*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	3)	"open" oscillator transformer *No. 15*
Intermittent reception, Distortion	1)	"shorted" grid condensers
	2)	check compensating condenser *No. 40, 49* or *55*—see *Note* (*L*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Distortion, Muffled and choked reception	1)	leaky 0.05-mfd. black-encased blocking or coupling condenser between the plate of the 75 tube and the grid of the 42 driver. It is located near the 42 driver tube socket
Distortion at resonance peak of station	1)	check compensating condenser *No. 55*—see *Note* (*L*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Distortion at low volume	1)	"shorted" condenser *No. 45*
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 71*
	2)	"shorted" primary in input transformer *No. 74*
Whistling and noise	1)	see *Note* (*M*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Whistling or squealing	1)	"open" condenser *No. 3* or *No. 39*
Motorboating sound	1)	"open" condenser *No. 82*
Hum	1)	"open" section in condenser *No. 86*
	2)	"shorted" condenser *No. 88*

PHILCO 660X

Excessive hum (increases when the black cardboard underneath chassis is touched)	1)	in some receivers, this cardboard becomes warped so it almost touches some of the parts. As it is painted with a black carbon paint it conducts an induction current which causes a disturbing hum. Remove the cardboard and turn it over. If the hum still persists, remove it entirely

PHILCO 665

Faulty shadowgraph tuning meter	1)	small spring in the unit has slipped out of position, allowing the magnetic vane to fall out. Replace and adjust the spring
	2)	if a shadowgraph tuning meter burns out or "opens", check the 0.05-mfd. tubular condenser connected after the meter. If "leaky" or "shorted," it should be replaced as it will cause the new meter to burn out as soon as it is installed. This condenser is located on the wave-band switch near the front of the chassis
Inoperative	1)	"shorted" condenser *No. 93, 94* or *71*
	2)	"shorted" section in condenser *No. 82*
	3)	"shorted" section in condenser *No. 86* (indicated by overheated rectifier tube)
	4)	"shorted" condenser *No. 39* (indicated by *wide* tuning meter shadow)
	5)	"shorted" condenser *No. 59* (indicated by *narrow* tuning meter shadow)
	6)	"open" tuning meter *No. 46* (indicated by *narrow* tuning meter shadow)
	7)	"open" primary in input transformer *No. 74*
Inoperative, Intermittent reception over portion or all of broadcast band	1)	see *Note* (*D*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" oscillator transformer *No. 15*
	3)	if this is accompanied by "hiss," check the r-f choke mounted on the front wave-band switch section shield for an "open" circuited condition—examine especially for breaks at the lugs
Weak reception (intermittently)	1)	see *Note* (*L*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" or "shorted" compensating condenser *No. 40, 49,* or *55*
Distortion, Muffled and choked reception	1)	leaky 0.05-mfd. black-encased blocking or coupling condenser between the plate of the 75 tube and the grid of the 42 driver. It is located near the 42 driver tube socket
Distortion at resonance peak of station	1)	realign third i-f stage
	2)	replace *No. 3* i-f compensating condenser *No. 55* "opens" or "shorts"—see *Note* (*L*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Distortion at low volume	1)	"shorted" condenser *No. 45*
Distortion at high volume, Weak, "tinny" signal	1)	"shorted" condenser *No. 71*
	2)	"shorted" primary in input transformer *No. 74*
Hum	1)	"open" condenser *No. 86*
	2)	"shorted" condenser *No. 88*
Whistling and noise	1)	see *Note* (*M*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
Whistling or squealing	1)	"open" condenser *No. 39* or *No. 43*
Motorboating sound	1)	"open" condenser *No. 82*

PHILCO 680

Inoperative	1)	"grounded" resistor *No. 107*
	2)	"shorted" condenser *No. 68* (indicated by overheated rectifier tube)
	3)	"shorted" section in condenser *No. 76* or *No. 78*

(Cont'd)

PHILCO 680—*(Cont'd)*

Inoperative —*(Cont'd)*	4)	"shorted" section in condenser *No. 77* (indicated by resistor *No. 73* overheating)
	5)	"shorted" condenser *No. 113* (indicated by resistor *No. 112* overheating)
	6)	"shorted" section in condenser *No. 76* (indicated by resistor *No. 72* overheating)
	7)	"shorted" condenser *No. 18* or *No. 29*
Inoperative, Intermittent reception over portion or all of broadcast band	1)	see *Note* (*D*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" oscillator transformer *No. 41*
Distortion, Muffled tone at high volume levels (especially with tone control on "bass")	1)	open-circuiting 1-mfd. electrolytic condenser in the plate circuit of the second audio tube. Replace with new single unit, or the entire section in which this unit is contained
Distortion or vibration at high-frequency response	1)	check speaker cone—weak spider
Microphonic	1)	remove shields from i-f transformer *No. 132* and fasten leads from compensating condenser tightly against coil to prevent vibration
	2)	"noisy" resistors *No. 148* and *No. 151*. Replace
Hum	1)	"open" condenser *No. 68*
	2)	"shorted" condenser *No. 69*
Noisy reception	1)	defective type '6A3 tube (even though it may test O.K.). Replace
	2)	defective 300-ohm resistor connected in second audio tube circuit (Part *No. 151*)
	3)	"intermittently open" or "noisy" resistors *No. 148, 151* or *No. 53*
Whistling or squealing	1)	see *Note* (*M*) listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	"open" condenser *No. 15* or *No. 18*
	3)	"open" section in condenser *No. 76* or *No. 78*
Frequency drift (retuning receiver brings fading station back)	1)	check for loose rivets in compensating condenser assembly *No. 6*
	2)	tighten set-screws on dial assembly

PHILCO 700 Auto Radio

See Case Histories listed for Philco 10 Transitone Auto Radio

PHILCO 800 Auto Radio

See also Case Histories listed for Philco 10 Transitone Auto Radio

Inoperative	1)	sticking vibrator points. Replace with new vibrator unit
	2)	open- or short-circuited buffer condensers, causing arcing at the vibrator points. Test by unsoldering one lead in the power transformer primary
	3)	oscillator circuit out of alignment
Inoperative (vibrator, condensers, tubes check O.K.)	1)	replace power transformer

(Cont'd over)

PHILCO 800 Auto Radio—*(Cont'd)*

Intermittent reception, Distortion	1)	"open" coupling condenser to grid of 75 tube
	2)	faulty high-frequency by-pass condenser at diode return
Noisy, Erratic operation	1)	faulty tapped volume control with switch. Replace
Poor tone quality	1)	one section of 79 output tube blown

PHILCO 802 Auto Radios

See Case Histories listed for Philco 10 Transitone Auto Radio

PHILCO 805, 806, 807, 808, 809 Auto Radios

Inoperative	1)	broken leads on tuning condenser and base of set
Inoperative (no voltage), Weak	1)	84 tube weak or "shorted"
	2)	faulty vibrator
	3)	condenser (Part No. 30-4051) "shorted" across plates of 84 tube
No signal, but hums and howls	1)	broken condenser lead at terminal strip
Weak reception	1)	out of alignment. Realign i-f
	2)	melted wax in the i-f trimmers changes the capacity. Remove trimmers, clean, and realign the receiver
Noisy reception	1)	by-pass condensers on the underside of chassis break loose due to vibration of car. Repair by securing each condenser to chassis with a bracket
Vibrator hash, Buzz	1)	insert an iron-core "A" choke in series with the speaker field. Choke used must be of low-resistance and a few henries inductance
Noisy and scratchy	1)	replace volume control
Rattling (806 receiver)	1)	bond to chassis all the ground terminals riveted to sockets
Whistling or squealing accompanied by howling	1)	"open" first r-f cathode by pass condenser
Noisy or sputtering reception while car is in motion, but disappears when car stops. May appear again when set is shaken (806 Receiver)	1)	loose shield can on i-f transformer—or any other loose shield in the set. The cans are held by means of spring clips to the chassis. When they become worn, or lose their tension the can will move when the receiver is shaken. Soldering the top clip to the shield can and to the chassis will stop the trouble

PHILCO 816, 817, 818, 818K, 819 Auto Radios

Inoperative	1)	"open" oscillator coil (3-lug tapped coil)
	2)	"open" speaker
	3)	faulty vibrator
	4)	open-circuited audio coupling-condensers (connecting leads at eyelets, or within housing)
Intermittent reception	1)	see remedies listed under *fading* for Philco 70 receiver
	2)	defective i-f trimmer condenser, usually the first i-f secondary trimmer that can

(Cont'd)

PHILCO 816, 817, 818, 818K, 819 Auto Radios—*(Cont'd)*

Intermittent reception —*(Cont'd)*		be reached from the back of the chassis. Push this trimmer gently with a balancing tool with the set on and note the result
	3)	faulty Local-Distance switch (mounted on the control head). Replace
	4)	ground open end of the 500-ohm resistor tied to the 78 i-f tube cathode
Distortion	1)	75 tube "weak"
	2)	84 tube "weak"
	3)	faulty vibrator
Noisy	1)	faulty 6A7 tube
Vibrator hash, Buzz	1)	insert an iron-core "A" choke in series with the speaker field. Choke used must be of low-resistance and a few henries inductance
84R tube glows	1)	replace with 84 tube (84R tube in set is different from 84 tube)
Overloading	1)	set "peaked" too high. Detune i-f amplifier slightly
Hum	1)	"open" electrolytic block
Interference from airport radio beacon stations transmitting at 260-kc (the i-f of the receiver)	1)	re-adjust the i-f compensating condenser at 250- or 270-kc
Fading after set operates satisfactorily for some time (turning switch off and on restores set to normal operation for awhile)	1)	intermittently open-circuiting 0.01-mfd. coupling condenser connected between the plate of the type '27 second detector tube and the grid of the type '27 first a-f tube
Low motorboating	1)	replace first audio grid resistor with 100,000-ohm unit
Rattling	1)	bond to chassis all "ground" terminals riveted to sockets
Noisy, sputtering reception while car is in motion	1)	loose shield cans. Solder top clip to shield cans and to chassis for more "positive" grounding
Whistling or squealing accompanied by howling	1)	"open" first r-f cathode by-pass condenser
Fuse blows when connection is made	1)	if resistance between rectifier cathode and ground measure only about 1,400 ohms, it will be found that the rheostat arm is shorted to ground. Replace tone control

PHILCO 920 Auto Radio

Adjusting or servicing the chassis	1)	when adjusting or servicing the chassis it is necessary to place the chassis on a steel base plate in order to prevent the set from oscillating. Normally, the housing acts as the base plate, but with the chassis removed from the housing it is necessary to use a separate base plate. The plate must make a good metallic contact with the sub-base Philco Part *No. 28-5946* is a base plate made especially for this purpose

PHILCO 921, 922

Inoperative (dead "short" in "A" circuit)	1)	if dead "short" persists when vibrator is removed, remove power transformer enclosing can and inspect for evidences of grounding of wires or terminals to this can. Clear any such grounds, and line inside of can with insulating paper before replacing it

PHILCO 931, 932

Vibrator "hash"	1)	poor contacts between loktal tubes and sockets. Clean all contact surfaces thoroughly, and make sure good firm contact is established when the tubes are reinserted in their sockets

PHILCO 936

See also Case History listed for Philco 931 receiver

Vibrator "hash"	1)	bond ground terminal on terminal strips to ground with bonding braid

PHILCO 1708, 1808 Auto Radios

Intermittent reception	1)	replace r-f coupling condenser that is part of r-f coil assembly (*Part No. 65-0421*)

PHILCO *(CANADIAN)* RECEIVERS

Fading	1)	connecting wires drawn too tightly around the edges of projecting condenser cases causing permanent or intermittent short-circuits to chassis. Insulate all such places by winding tape around edges

PIERCE-AIRO

PIERCE-AIRO 524

Motorboating sound	1)	high-resistance connection between the ground of the by-pass condenser block and the chassis

PIERCE-AIRO 724

Weak reception (with oscillation)	1)	check for "open" cathode by-pass condenser in first and second r-f stages. These are in a single unit which may be reached by turning the chassis upside down. Inspect the r-f coil partitions for a double-unit 0.5-mfd. condenser block—the one nearest the rear of the chassis and mounted on the coil partition. Use 0.5-mfd. replacements

PIERCE-AIRO 746

Weak reception accompanied by whistling or squealing	1)	"open" 0.5-mfd. cathode by-pass condenser in first and second r-f stages (this is the unit nearest rear of chassis located on r-f coil partition under chassis)

PILOT

PILOT 7, 8

Distortion, Low sensitivity, Whistling or squealing	1)	carbonized voltage-divider system composed of a 7,500-ohm and 9,000-ohm carbon resistors. A quick ohmmeter check may be made between the screen grid of the 2A5 and chassis. A reading of approximately 16,500 ohms should be obtained here. The large carbon resistor should be replaced with a 10-watt wire-wound unit

(Cont'd)

PILOT 7, 8—*(Cont'd)*

Distortion, Hum (grids of 2A5 tube glow red)	1)	"shorted" or "leaky" 2A5 cathode by-pass condenser

PILOT "DRAGON" 10

Excessive 60-cycle hum	1)	grounded reflector mounted behind the pilot lamp. Insulate the sharp corner of the reflector with a piece of fibre to prevent the short-circuiting of tube filaments to ground

PILOT FM 12

All complaints	1)	replace following resistors: screen grid circuit of 6SJ7, 40,000 and 15,000 ohms, replace with 1-watt carbon resistors; screen-grid circuit of 6AC7 2nd i-f amplifier, replace 40,000-ohm resistor with 1-watt carbon. Do not use insulated-type resistors. Plate circuit of 6SJ7, replace 75,000-ohm unit with 2-watt insulated resistor. Replace the 75,000-ohm resistor, in the voltage divider circuit of the noise suppression circuit, with 2-watt insulated type; 60,000-ohm screen-grid resistor of 6AC7 1st r-f stage, replace with 2-watt insulated type; two 25,000-ohm resistors in voltage supply of oscillator circuit of 6K8—replace with 2-watt insulated type from "B+" to center and 1-watt insulated type from center to grid. The 5-mmfd. temperature-compensated condenser in this circuit must be taped securely to both resistors and be put back in exactly the same place or else the low-frequency end of the F.M. band will shift either up or down dial scale. The 0.1-meg. resistor from "B+" to center, in the plate of the "eye" circuit, should be changed to a 50,000-ohm 1-watt carbon resistor. This completes all the changes necessary to bring this receiver up to date

PILOT 23, P23, 25, P25

Insensitive	1)	i-f amplifier out of alignment
	2)	r-f amplifier out of alignment
	3)	defective tube
	4)	"open" antenna coil
	5)	"shorted" trimmer on i-f tertiary coil
Distortion	1)	defective tube
	2)	grounded "shorting" contact
	3)	cone not centered properly
	4)	shorted trimmer on tertiary coil of i-f transformer
	5)	i-f amplifier out of alignment. Alignment should be made with an oscillograph
Noisy reception	1)	defective tube
	2)	defective wave-band switch contacts
Hum	1)	grounded pilot light socket
	2)	field grounded to speaker frame
	3)	leakage between prong terminals of tube sockets due to accumulation of foreign matter, especially on No. 6Q7 tube socket. Clean socket with lacquer thinner, or replace
	4)	defective electrolytic condenser
	5)	defective tube
	6)	poor ground connection will cause hum modulation on signal

PILOT 31-81 (RAINBOW SUPER)

Intermittent reception, Fading	1)	replace the 10,000-ohm, ½-watt resistor in the cathode circuit of the detector-oscillator tube with a 6,000-ohm unit
Hum	1)	if plate voltages are low and there is no bias on 47 tube, check for "open" 500,000-ohm resistor in 47 bias divider circuit
Erratic operation	1)	defective 10,000-ohm resistor connected between the screens of the first detector-oscillator and the second detector tubes. Replace with a 1-watt unit

PILOT 33

Same Case Histories as those listed for Pilot 403 receiver

PILOT 43, 55

Whistling or squealing	1)	set minimum setting of volume control for 100- or 200-ohms

PILOT X-63

Insensitive in center of band	1)	i-f amplifier out of alignment
	2)	r-f amplifier out of alignment
	3)	"short-circuiting" contact in band switch not shorting
Weak audio reception	1)	high-resistance phono jack contact
Noisy reception	1)	loose or dirty contacts in band switch
	2)	intermittently open-circuiting phono jack contact
	3)	defective type '42 tube (even though it may test O.K.). Replace with new tube
	4)	change type '6A7 tube
Hum	1)	reverse the speaker field terminal connections
	2)	a-c leads too close to volume control. Re-route them
	3)	open-circuited or leaky filter condensers. Replace with new units
	4)	short-circuited r-f by-pass condenser. Replace with new unit
	5)	short-circuited type '42 tube cathode condenser. Replace with new unit
	6)	defective type '75 tube (even though it may test O.K.). Replace with new tube
	7)	change type '6A7 tube
Distortion	1)	grounded short-circuiting contact
	2)	short-circuited i-f or r-f grid return by-pass condenser. Replace with new unit
	3)	leaky audio coupling condenser. Replace with new unit
	4)	change type '75 tube
	5)	change type '42 tube
	6)	defective type '42 tube cathode by-pass condenser. Replace with new unit
	7)	voice coil requires recentering
	8)	i-f amplifier out of alignment
Microphonics	1)	chassis too far forward in cabinet
	2)	defective type '6A7 tube (even though it may test O.K.). Replace with new tube
	3)	tuning dial assembly touching front of cabinet

PILOT X-73

Inoperative, No signal	1)	open-circuited fuse
	2)	reversed battery connections
Weak reception	1)	low battery voltage
	2)	receiver circuits out of alignment

(Cont'd)

PILOT X-73—*(Cont'd)*

Insensitive in center of band	1)	"short-circuiting" contact in band switch not shorting
	2)	receiver aligned on image frequency
Weak audio reception	1)	defective type '19 tube. Replace with new tube
	2)	weak permanent magnet in speaker
Distortion	1)	grounded short-circuiting contact
	2)	leaky audio coupling condenser. Replace with new unit
	3)	open-circuited audio transformer. Replace with new unit
	4)	wrong "C" battery voltage
	5)	low filament voltage
	6)	short-circuited cathode by-pass condenser. Replace with new unit
Noisy reception	1)	weak batteries
	2)	defective type '19 tube (even though it may test O.K.). Replace with new tube
Speaker rattle	1)	metal filings in speaker

PILOT 81, 84

Same Case Histories as those listed for Pilot 7, 8 receivers

PILOT 93

Whistles all over dial	1)	receiver circuits out of alignment
Fading	1)	defective triple-unit 0.1-mfd. condensers just below 170-ohm filament resistor—usually leaky or open-circuited. Replace with separate tubular condensers

PILOT 103

Insensitive in center of band	1)	i-f amplifier out of alignment
	2)	r-f amplifier out of alignment
Audio oscillation	1)	tone control condenser too close to volume control. Shift position of this unit
Noisy reception	1)	change type '42 tube
	2)	change type '6A7 tube
Hum	1)	open-circuited or leaky filter condenser
	2)	"shorted" '42 tube cathode cond.
	3)	short-circuited r-f by-pass condenser
Microphonics	1)	chassis too far forward in cabinet
	2)	defective type '6A7 tube
	3)	tuning dial assembly touching front of cabinet
	4)	defective type '75 tube
	5)	defective type '6A7 tube
Distortion	1)	defective type '75 tube
	2)	defective type '42 tube
	3)	faulty '42 tube cathode by-pass cond.
	4)	speaker voice coil rubbing on pole piece
	5)	i-f amplifier out of alignment

PILOT 114, 115

Inoperative	1)	"open" voltage divider
Intermittent reception, Fading, Oscillator drift	1)	since an inter-station noise suppressor stage is employed, a shift or frequency drift of only 4 or 5 kc, will produce an inoperative condition when the silencing stage is switched on and being used. Reception can again be obtained by re-tuning to the carrier. Check for

(Cont'd)

PILOT 114, 115—(Cont'd)

Intermittent reception, Fading, Oscillator drift —(Cont'd)	an intermittently "open" 0.01-mfd. oscillator plate coupling condenser. This condenser connects between the 76 oscillator tube plate, and the arm contact of the rear section of the wave-band switch. Upon replacement mount the unit firmly to remove the possibility of vibration and consequent microphonics
Insensitive in center of band	1) i-f amplifier out of alignment 2) r-f amplifier out of alignment
Noisy reception	1) dirty or corroded rotor wiping contacts on gang condenser. Clean contacts or solder flexible pigtails between rotor and condenser frame 2) dial-drive disc touching chassis 3) change type '42 tube 4) change type '6A7 tube
Hum	1) open-circuited or leaky filter condenser 2) short-circuited cathode condenser on type '42 tube 3) short-circuited "r-f by-pass" condenser 4) defective type '75 tube 5) defective type '6A7 tube
Distortion	1) defective type '75 tube 2) defective type '42 tube 3) defective type '42 tube cathode by-pass 4) speaker voice coil rubbing on pole piece 5) i-f amplifier out of alignment 6) leaky audio coupling condenser. Replace with new unit 7) leaky i-f or r-f grid return by-pass condenser. Replace with new unit 8) grounded short-circuiting contact
Microphonics	1) chassis too far forward in cabinet 2) defective type '6A7 tube 3) tuning dial assembly touching front of cabinet

PILOT 123

Inoperative, No signals	1) short-circuited field coil
Insensitive in center of band	1) i-f amplifier out of alignment 2) r-f amplifier out of alignment 3) "shorting" contacts on band switch not shorting
Noisy reception	1) defective tube 2) intermittent contact in band switch 3) speaker cone out of alignment
Hum	1) open-circuited or leaky filter condenser 2) short-circuited cathode condenser on type '43 tube 3) short-circuited r-f by-pass condenser 4) defective type '75 tube 5) defective type '6A7 tube
Distortion	1) defective type '76 tube 2) defective type '43 tube 3) defective type '43 tube cathode by-pass 4) speaker voice coil rubbing on pole piece 5) i-f amplifier out of alignment
Microphonics	1) chassis too far forward in cabinet 2) defective type '6A7 tube 3) tuning dial assembly touching front of cabinet

PILOT 153

No signal	1) open-circuited fuse 2) reversed battery connections
Weak reception	1) low battery voltage 2) receiver circuits out of alignment

(Cont'd)

PILOT 153—(Cont'd)

Weak reception in center of band	1) receiver aligned on image frequency
Noisy reception	1) weak batteries 2) defective type '35 tube
Distortion	1) open-circuited audio transformer 2) wrong "C" battery voltage 3) low filament voltage 4) short-circuited cathode by-pass condenser. Replace with new unit
Speaker rattle	1) metal filings in speaker

PILOT 183

Insensitive in center of band	1) i-f amplifier out of alignment 2) r-f amplifier out of alignment
Noise	1) change type '6F6 tube 2) change type '6A8 tube
Hum	1) open-circuited or leaky filter condenser 2) short-circuited cathode condenser on type '6F6 tube 3) short-circuited r-f by-pass condenser 4) defective type '6H6 tube 5) defective type '6A8 tube
Distortion	1) defective type '6H6 tube 2) defective type '6F6 tube 3) defective type '6F6 tube cathode by-pass condenser 4) speaker voice coil rubbing on pole piece 5) i-f amplifier out of alignment
Microphonics	1) chassis too far forward in cabinet 2) defective type '6A8 tube 3) tuning-dial assembly touching front of cabinet

PILOT 193

Insensitive	1) defective tube (even though it may test O.K.). Replace with new tube 2) i-f amplifier out of alignment 3) r-f amplifier out of alignment 4) wave-trap tuned to wrong frequency. (*Note*: this will also cause interference)
Noisy reception	1) intermittent contact between tube elements 2) weak contact finger on wave-band switch
Hum	1) defective tube (even though it may test O.K.). Replace with new tube 2) defective filter condenser. Replace with new unit 3) defective audio cathode by-pass condenser. Replace with new unit
Distortion	1) short-circuited r-f and i-f grid return condenser 2) grounded short-circuiting contact 3) short-circuited cathode by-pass condenser. Replace with new unit

PILOT X201

Tubes light only momentarily, when set is shaken	1) undersized heater prong on 25Z5 tubes. Prong makes contact only when the tube is moved

PILOT 203

Insensitive in center of band	1) i-f amplifier out of alignment 2) r-f amplifier out of alignment
Noisy reception	1) change type '43 tube 2) change type '6A7 tube

(Cont'd over)

PILOT 203—*(Cont'd)*

Hum	1) open-circuited or leaky filter condenser 2) short-circuited cathode condenser on type '43 tube 3) short-circuited r-f by-pass condenser 4) defective type '76 tube 5) defective type '6A7 tube
Distortion	1) defective type '76 tube 2) defective type '43 tube 3) defective type '43 tube cathode by-pass 4) speaker voice coil rubbing on pole piece 5) i-f amplifier out of alignment
Microphonics	1) chassis too far forward in cabinet 2) defective type '6A7 tube 3) tuning-dial assembly touching front of cabinet

PILOT X-203, 205

Insensitive	1) defective tube 2) i-f or r-f circuits out of alignment 3) wave trap aligned to a frequency in the "broadcast" band
Distortion	1) defective tube 2) grounded i-f or r-f grid return 3) speaker cone not centered 4) defective electrolytic condenser in ground circuits of 75 and 25L6 tubes
Noisy reception	1) defective tube 2) corroded band-switch contacts. Clean with lacquer-thinner 3) noisy volume control, replace with new unit
Hum	1) defective tube 2) grounded pilot light socket 3) defective electrolytic condenser 4) leakage between terminals of tube socket

PILOT 213

Insensitive in center of band	1) i-f amplifier out of alignment 2) r-f amplifier out of alignment 3) "shorting" contact in band switch not shorting
Noisy reception	1) change type '6F6 tube 2) change type '6A8 tube
Hum	1) open-circuited or leaky filter condenser 2) short-circuited cathode condenser on type '6F6 tube 3) short-circuited r-f by-pass condenser 4) defective type '6H6 tube 5) defective type '6A8 tube
Distortion	1) defective type '6H6 tube 2) defective type '6F6 tube 3) defective type '6F6 tube cathode by-pass condenser 4) speaker voice rubbing on pole piece 5) i-f amplifier out of alignment
Microphonics	1) chassis too far forward in cabinet 2) defective type '6A8 tube 3) tuning-dial assembly touching front of cabinet

PILOT 243

Insensitive in center of band	1) i-f amplifier out of alignment 2) r-f amplifier out of alignment 3) "shorting" contact in band switch not shorting
Type '6E5 tube inoperative	1) grid filter short- or open-circuited 2) plate resistor short circuiting
Noisy reception	1) change type '6F6 tube 2) change type '6A8 tube

(Cont'd)

PILOT 243—*(Cont'd)*

Hum	1) open-circuited or leaky filter condenser 2) short-circuited cathode condenser on type '6F6 tube 3) short-circuited r-f by-pass condenser 4) defective type '6H6 or '6A8 tube
Distortion	1) defective type '6H6 or '6F6 tube 2) defective '6F6 tube cathode by-pass cond. 3) speaker voice coil rubbing on pole piece 4) i-f amplifier out of alignment
Microphonics	1) chassis too far forward in cabinet 2) defective type '6A8 tube 3) tuning-dial assembly touching front of cabinet

PILOT 253, 255

Insensitive in center of band	1) i-f amplifier out of alignment 2) r-f amplifier out of alignment 3) "shorting" contact in band switch not shorting
Weak audio reception	1) defective vibrator unit 2) defective tube (even though it may test O.K.). Replace with new tube 3) weak speaker magnet
Noisy reception	1) defective vibrator unit 2) defective tube (even though it may test O.K.). Try a new tube 3) connection wires not in original positions 4) by-pass condenser not connected to original ground connection. 5) weak battery
Hum	1) open-circuited or leaky filter condenser* 2) "shorted" cathode cond. on '41 tube 3) short-circuited r-f by-pass condenser* 4) defective type '75 or '6A7 tube
Distortion	1) defective type '75 or '41 tube 3) defective '41 tube cathode by-pass cond.* 4) speaker voice coil rubbing on pole piece 5) i-f amplifier out of alignment
Microphonics	1) chassis too far forward in cabinet 2) defective type '6A7 tube 3) tuning-dial assembly touching front of cabinet

*Important Note: *When replacing condensers, be sure to make the connections exactly the same as they were originally.*

PILOT 274, 284

Same Case Histories as those listed for Pilot 23 receiver

PILOT 293, 295

Insensitive	1) "shorting-shoe" on band switch not making contact 2) defective tube 3) r-f circuits out of alignment 4) i-f circuits out of alignment
Hum	1) defective tube (even though it may test O.K.). Replace with new tube 2) defective filter condenser. Replace with new unit 3) reverse the speaker field terminal connections 4) open- or short-circuited audio tube cathode condenser. Replace with new unit
Distortion	1) defective tube (even though it may test O.K.). Replace with new tube 2) short-circuited r-f grid return by-pass condenser. Replace with new unit 3) grounded short-circuiting contact 4) voice coil requires recentering

(Cont'd)

PILOT 293, 295—*(Cont'd)*

Microphonics	1)	microphonic tube
	2)	condenser gang not properly cushioned
	3)	i-f amplifier not aligned to correct frequency (trimmers are loose)
Noisy reception	1)	defective tube
	2)	dirty wave-band switch contacts. Clean by brushing with lacquer thinner

PILOT 304

Insensitive	1)	defective tube (even though it may test O.K.). Replace with new tube
	2)	r-f amplifier out of alignment
Noisy reception	1)	defective tube (even though it may test O.K.). Replace with new tube
	2)	defective wave-band switch contacts
Hum	1)	defective type '25A6 tube. Replace
	2)	defective type '25Z6 tube. Replace
	3)	defective filter condenser. Replace
Distortion	1)	defective tube (even though it may test O.K.). Replace with new tube
	2)	grounded short-circuiting contact
Microphonics	1)	r-f amplifier not properly cushioned
	2)	chassis not properly cushioned in cabinet (table model only)

PILOT 364

Insensitive in center of band	1)	i-f amplifier out of alignment
	2)	r-f amplifier out of alignment
	3)	"shorting" contact in band switch not shorting
Type '6E5 tube inoperative	1)	grid filter cond. short- or open-circuited
	2)	plate resistor short-circuiting
Noisy reception	1)	change type '6F6 tube
	2)	change type '6L7 tube
Hum	1)	open-circuited or leaky filter condenser.
	2)	short-circuited cathode condenser at type '6F6 tube
	3)	short-circuited r-f by-pass condenser
	4)	defective type '605 or '6L7 tube
Distortion	1)	defective type '605 or '6F6 tube
	2)	defective type '6F6 tube cathode by-pass condenser. Replace with new unit
	3)	speaker voice coil rubbing on pole piece
	4)	i-f amplifier out of alignment
Microphonics	1)	chassis too far forward in cabinet
	2)	defective type '6L7 tube
	3)	tuning dial assembly touching front of cabinet

PILOT 403

Insensitive	1)	i-f amplifier out of alignment
	2)	r-f amplifier out of alignment
	3)	defective tube (even though it may test O.K.). Replace with new tube
	4)	band aligned to image frequency
Insensitive on short-wave band	1)	wave-trap tuned to frequency in broadcast band, causing interference
Noisy reception	1)	defective tube (it may test O.K.). Replace with new tube by substitution
	2)	dirty or corroded band switch contacts
Hum	1)	defective filter condenser. Replace
	2)	defective audio by-pass cond. Replace
	3)	reverse speaker field connections
Microphonics	1)	microphonic tube
	2)	condenser gang not properly cushioned
Distortion	1)	defective tube (even though it may test O.K.) Replace with new tube
	2)	short-circuited r-f grid return condenser.
	3)	short-circuited audio cathode by-pass condenser. Replace with new unit
	4)	voice coil requires recentering

PILOT 423, 425

Same Case Histories as those listed for Pilot 23 receiver

PILOT 576

Same Case Histories as those listed for Pilot 293 receiver

PILOT 623

Same Case Histories as those listed for Pilot 23 receiver

PILOT T 1451

Hum (when operated from a-c power line)	1)	remove outer insulation from filter choke. Separate the leads so they cannot "short" together, and tape each one individually

PILOT T 1452

Weak reception, Tone quality poor	1)	check 2-megohm volume control for large increase in resistance. Replace

PONTIAC *(United Motors Service)* AUTO RADIOS

PONTIAC 1934 Auto Radio

Motorboating sound, Steady whistle	1)	broken r-f cathode by-pass condenser lead. Look for largest condenser of cluster of three jammed between lid and other two

PONTIAC "MASTER" Radio (Auto Radio)

Weak reception	1)	speaker field not energized magnetically. Due to speaker frame not making good contact to chassis

PONTIAC 544267 Auto Radio

Inoperative over part of range—especially on low-frequency end	1)	failure of oscillator to tune over entire range due to change in capacity of fixed padding condenser used in oscillator circuit. Replace with identical condenser obtained from United Motors Service, as the size is quite critical

PONTIAC 544268 Auto Radio

Fading, Mushy tone	1)	replace 0.02-mfd. (C21A) condenser which couples triode plate of 6F7 tube to control-grid of the 85
	2)	replace the 0.04-mfd. (C21B) condenser between triode grid and center tap of volume control

PONTIAC 544291 "Air Chief" Auto Radio

Intermittent change in volume, Noisy reception	1)	loose clip on threaded brass piece on top of tuning condenser stator plates. Solder this clip to brass piece

PONTIAC 983507 "Air Chief" Auto Radio

Weak reception, Distortion	1)	if volume increases when 6SF5 inverter tube is removed, replace the volume control

PONTIAC 983679 "Air Chief" Auto Radio

Intermittent change in volume, Noisy reception	1)	loose fastening and grounding lugs on i-f shield cans. Bond shields to chassis

PONTIAC 983679 "Air Chief" Auto Radio

Inoperative (fuse blown)	1)	"A" lead "shorted" to metal cover plate over power supply section of receiver. Insulate these from each other

RADIOLA

(For Case Histories of Radiola receivers refer to the RCA section. All Radiola receivers are listed there in numerical order)

RADIO PRODUCTS CO.

(See listings under AIR CASTLE)

RCA and RCA-VICTOR *(AMERICAN)*

RCA-Victor (*Canadian*) receivers are listed following the end of the RCA and RCA-Victor (*American*) group. See also the RCA-Victor Canadian-American receiver Cross-Index in *Section 6* of this *Handbook*

RCA (General Servicing Notes)

Intermittent reception	1)	clean all variable condenser wiper contacts and bend to provide better contact. If this does not completely remedy the trouble, install pigtails to the rotor sections
Intermittent or noisy reception	1)	see Case History above for "Intermittent reception"
	2)	in models using a 745-mmfd. fixed condenser as oscillator padder, replace with a condenser of same value removed from oscillator grid lead, and replace grid condenser with stock unit having approximately same value. Padder condenser value is critical and stock replacement is unsatisfactory, whereas grid condenser value is not critical
Weak reception in battery-operated models that use 3Q5GT output tubes	1)	burnout of one-half of the double filament in this tube. Check for continuity between prongs 2 and 8 and between 8 and 7
Fading	1)	in receivers using AVC, try replacing AVC tube with a new one
"Popping" when tuning	1)	in AVC models, try replacing all screen grid tubes with new ones—one at a time
Motorboating sound	1)	if this occurs over entire dial in AVC models, connect a small resistor of about 0.2-ohms in series with one of the AVC tube heater leads. If necessary, also connect one in series with the r-f tube heater
Motorboating sound and whistling or squealing	1)	if antenna coil is located on top of chassis near the pilot lamp, ground the terminal on the r-f coil to chassis which has the *yellow* external ground lead connected to it
Noisy	1)	check volume control for noisy operation
"Magic eye" fluorescent glow crosses over on strong stations—or does not change enough on any station	1)	change value of resistor connected from ray-control electrode to ground. Use higher value of resistance if ray crosses; smaller value if it does not change enough

(Cont'd)

RCA (General Servicing Notes)—*(Cont'd)*

Noisy auto-radio receivers	1)	before attempting to adjust the vibrator to eliminate excessive interstation noise, try one or more new 6A7 tubes. In most cases the selection of a proper 6A7 tube will eliminate the noise
Troubles in "Little Nipper" series of receivers	1)	rattling—apparently due to off-center cone. Due to speaker housing binding on edge of receiver chassis. Shim out the speaker with 1/16 inch washers placed in back of field housing so the speaker frame clears the chassis
	2)	hum with record players. The circuit design of "Little Nippers" is such that the Victrola plug must be removed when not in use, or when it is desired to operate it as a radio. The Underwriters' Laboratories did not originally approve an isolating capacitor (between jack and chassis) larger than 0.01-mfd. on the particular instruments involved. Subsequent approval has been obtained for use of values up to 0.1-mfd., which will reduce hum pickup to an un-objectionable level
	3)	if 24-ohm pigtail resistor burns out, check type 47 pilot light before installing a new resistor
Hum (in AC-DC models with PM speaker)	1)	in AC-DC receivers that us a PM (permanent magnet) speaker, effective humbucking is obtained through the use of an output transformer with tapped primary. The tap is established at a point where the "ampere turns" of ripple in the direction of the output plate balances the "ampere turns" of ripple in the direction of the screen and other plate circuits. High residual hum (at zero volume setting) may be due to incorrect balance, and can usually be eliminated by checking for the following troubles and eliminating them: (a) Output tube with off-standard characteristics (b) Filter capacitor too low capacity, or too high internal resistance (c) "B" filter resistor not correct value. Measure resistance and change if necessary (d) Cathode bias resistor of output tube not correct value (e) If hum persists, change the output-tube-plate by-pass to rectifier cathode instead of to-output tube cathode (f) If none of preceding steps reduces the hum to a satisfactory level, replace the output transformer
Replacing rubber tires on rim-drive phono turntables	1)	remove old tire by stretching and pulling over drive disc edge. Thoroughly clean drive disc to remove burrs or foreign particles. Place new tire over the drive disc. Avoid any twisting or excessive stretching of the tire. Roll disc and tire on a flat clean surface while simultaneously applying a slight downward pressure on the disc shaft. This will allow the tire to seat itself properly in the "V" shaped groove on the drive disc and take up for any uneven stretching of the rubber tire. Clean rubber tire with carbon tetrachloride (Carbona)

(Cont'd)

RCA (General Servicing Notes)—*(Cont'd)*

Governor type phono motors	1)	to assure normal and satisfactory service, every motor should be lubricated in accordance with the manufacturer's instructions. Only mineral-base oils and greases should be used. For points requiring oil, use a type with a high viscosity index (with a viscosity rating of (SAE 20-30). For points requiring grease, a light gear grease with good clinging properties should be used.
	2)	*Governor wavers*: Drifting of motor speed at a slow rate, or erratic shift to other than normal speed, is generally caused by (1) binding of rotor or spindle bearings due to lack of lubrication, (2) scored shafts, or bearings, (3) binding due to tight adjustment of thrust bearing B, (4) binding of turntable spindle bearing on motor board (where used), (5) improper centering of motor with respect to turntable spindle
	3)	*Governor chatters*: When the governor rattles or flutters rapidly, accompanied by excessive mechanical noise, the likely source of trouble is (1) glazed felt friction pad due to lack of lubrication, (2) rotor not centrally positioned in stator, (3) thrust bearing A worn, (4) misaligned or rough governor disc
"Fading" in 1936 receivers having a "music-speech" switch	1)	check the tone compensating condenser
"Fading" and distortion in 1936 and 1937 receivers	1)	replace volume control
Skipping of electric tuning mechanism in 1938 electric-tuning receivers	1)	often caused by pushing knobs on too far. Remove both tuning knobs and place felt washers between the large knob and the cabinet, and between the knobs
"Stopping at one end" in 1938 electric-tuning receivers	1)	loosen the two hexagonal nuts holding the motor-reversing switch on the back of the condenser gang. Move it down a little in the slots provided, and retighten the nuts
"Sputtering" during tuning of early 1938 electric-tuning receivers	1)	clean off tuning adjustment discs in rear of set with very fine sandpaper. Then apply *Nujol* or similar oil (sparingly with a cloth) to them
Adjusting automatic record changers in 1938 and 1939 receivers	1)	jamming of 10-inch records is generally related to adjustment of record separator knives. More satisfactory operation is obtainable by using a spacing of 0.058 inches for 10-inch records in lieu of the originally specified 0.055 inches. If adjustment does not give foolproof operation, replace the separator knives
	2)	needle landing in 10-inch position on a 12-inch record may be caused by sluggish action of pickup locating lever (*17*). It is advisable, for such a case to increase the strength of the pickup locating lever tension spring, or replace it with spring Stock *No. 31875*
	3)	if the needle misses the record due to excessive vibration on landing, the locating lever (*14*) spring (*No. 35* on U-125, *No. 33* on others) should be made heavier, or replaced with Stock *No. 32436*. If

(Cont'd)

RCA (General Servicing Notes)—*(Cont'd)*

Adjusting automatic record changers in 1938 and 1939 receivers —*(Cont'd)*		difficulty persists, use spring Stock *No. 31875*
	4)	bent guide posts on the motor mounting bracket may bind against the motor board causing mechanical hum or rumble. The posts may be removed from the bracket entirely by sawing, if care is exercised in centering motor in respect to turntable spindle and its coupling
	5)	will not complete record after playing several. Bend clutch pressure fingers slightly. See that cabinet is level
Automatic tuning in 1939 receivers	1)	station indicator does not stop when buttons are depressed, but keeps rocking back and forth. Insert a small spring behind flywheel (between motor and washer) so that when current is interrupted, motor will disengage. Usually an ordinary small electric motor brush spring of two or three turns is large enough
"Excessive noise" pickup between stations in 1941 receivers	1)	it may be found necessary in certain localities to reduce the sensitivity of these receivers in order to reduce the effect of noise pickup in between stations. This can be done by adding larger resistors in the i-f cathode connected between the existing 100 ohms and ground with a 1/10-mfd. condenser in shunt with the added resistor. On the receivers which do not use a 100-ohm resistor in the i-f cathode, the resistor and capacity combination should be added between the cathode and ground. The value of the resistor could be anything between 500 and 3,000 ohms, depending upon the sensitivity reduction required

RCA AVR-1

Same Case Histories as those listed for RCA 140, 141 receivers

RCA HF-1

Failure of oscillator to function properly over entire band	1)	if receiver contains a 33,000-ohm resistor in position R-2, serving as grid leak for the 6A8 oscillator section, replace it with a 100,000-ohm ¼-watt resistor (Stock *No. 14560*)

RCA HF-2

Distortion	1)	"leaky" 0.1-mfd. condenser between 6J5 second audio tube and 6F6
	2)	"leaky" 0.025-mfd. coupling condenser from 6J5 phase inverter to 6F6
Hum	1)	dress *brown* lead connected to *No. 6* (*P*) terminal of 5T4 socket well away from the *No. 6* (blank) pin of the 6K7 i-f socket and from the *black* lead connected to same
Electric tuning mechanism operates noisily	1)	thoroughly lubricate slide rods which carry dial pointer. Use an oil that does not tend to harden with age and also clings well to the guides
	2)	lubricate the fork of AFC switch (where used) with similar oil
	3)	see that the dial drum is not rubbing against pilot light shields
	4)	check alignment between motor shaft and pinion gear shaft, to see that these are adjusted on the same axis. It may be necessary to "shim" the motor mounting to accomplish ideal alignment. (This applies to mechanical clutch type mechanism)

(Cont'd over)

RCA HF-2—(Cont'd)

Tuning motor fails to "pull into" running position, or "chatters" in and out of engagement

1) connect a 60-mfd. 40-volt (Stock *No. 32088*) condenser between the two top lugs (*No. 3* and *No. 4*) of the motor. Cut the existing lead from the motor winding to *No. 4* lug and secure it clear of the circuit

Push-buttons not latching

1) try elevating front of chassis about ⅛ inch by placing washers under its mounting feet, in order to obtain improved push-button operation
2) replace spring used at one end of latch bar to retain switch lever in the "on" position. Use stronger spring (Stock *No. 31970*)

RCA O-2

"Waver" or "wow" in phono reproduction

1) a regular "WOW" occurring on every revolution of the turntable, or every few revolutions.

(a) A frequent cause of this difficulty is faulty adjustment of the governor springs. If the governor weights seem to oscillate in and out when the motor is in operation, the spring tension of the three weights may not be evenly balanced. Loosen the three spring clamping screws and position the springs so that all three weights are held with the same tension.

(b) Another possible cause of this trouble is faulty adjustment of the governor bearings. To adjust these bearings:

First: Set the speed regulator lever so that the face of the felt friction pad is accurately parallel to the governor friction plate.

Second: Loosen both governor bearing set screws and position the governor so that the motor revolves at rated speed (78.4 rpm).

Third: Adjust the mesh of the worm and the fiber drive gear by turning the eccentric bearings. These should be set so that the worm meshes properly with the fiber gear without binding.

Fourth: Adjust the distance between bearings so that the governor turns freely with a minimum of end-play.

(c) A take-up spring is mounted on the governor friction plate shaft to ensure against lost motion and erratic operation of this plate. It is essential that this spring be in place and adjusted to provide adequate tension.

(b) Marred or broken teeth on either gear on the turntable shaft or on the intermediate gear shaft may cause this trouble. If inspection shows this to be the case, the defective gear should be replaced.

(e) eccentricity due to wear of the bottom spindle bearing. Install new bottom plate (Stock *No. 38395*) which comes complete with the bearings

2) the turntable loses speed, or "WOWS," on the louder parts of a record:

(a) This may be caused by failure of the governor to respond accurately to speed changes, due to excessive or irregular friction between the sliding friction plate and the governor shaft. When this occurs it may be corrected by removing the weights and working the plate back and forth until it frees up. If the governor shaft does not have a smooth surface it may be necessary to smooth it down slightly using "Crocus Cloth" or to replace the governor.

(b) This condition may also be caused by excessive friction in any part of the motor. Be sure that the governor bearings are properly adjusted as described in section 1 (b). Lubricate all bearings in the motor using a high grade light oil such as RCA Stock *No. 7227* Spring Motor Oil. The governor shaft, friction plate, and felt friction pad should also be lubricated with this oil. Lubricate the worm with a light grease such as RCA Stock *No. 10975* Electric Motor Grease. Remove the main spring and pack it with with a graphite lubricant such as RCA Stock *No. 7228*.

(Cont'd)

RCA O-2—(Cont'd)

3) the turntable speed changes erratically over long periods of time.

"Waver" or "wow" in phono reproduction —(Cont'd)

(a) This may be caused by binding of the main spring due to improper lubrication. To correct this, pack the spring with graphite grease as described in section 2 (b).

(b) Make sure that the tip of the main spring housing does not rub on the end of the winding shaft.

(c) Inspect the gear teeth on the main spring gear. If these are marred or broken, it may be necessary to replace the spring assembly.

RCA QB 2

Inoperative, Weak reception

1) the "A" supply in the CV-112 power unit used in Model QB2 is supplied through a copper-oxide dry-disc rectifier. Trouble may be due to a chemical change in this rectifier, which causes the "A" voltage to drop low enough to affect the performance of the receiver. The normal "A" voltage is 1.5 volts.

This condition is likely to occur in the rectifier when the power unit has been out of service for a long time (four months or more).

To reactivate the rectifier, it is only necessary to short the "A" plus and "A" minus terminals of the socket by connecting them together with a piece of wire for a period of FOUR MINUTES. The high temperature developed in the rectifier during this period has the tendency to restore the discs to their normal rectifying ability.

Circuit improvement to prevent repeated i-f or a-f transformer breakdown

1) in 1st production receivers, connect a 10-megohm ¼-watt resistor across the B+ circuit electrolytic condenser to discharge the condenser when the receiver is turned off, thus eliminating residual voltage in condenser and reducing electrolytic action in transformer windings

RCA QU2C, QU2M, QU3C, QU3M

Howling on short-wave bands

1) change condenser *C-41* from 0.007-mfd. to 0.005-mfd.

Improving receiver performance

1) change audio coupling condenser from 0.0025-mfd. to 0.01-mfd.
2) in the magnetic pickup circuit of the QU2M receiver change the 0.035-mfd. condenser to a 0.05-mfd. unit

RCA HF-4

Same Case Histories as those listed for RCA HF-2 receiver

RCA 4QB, 4QB4

Whistling or squealing

1) connect a 0.25-mfd. 350-volt paper condenser across electrolytic condenser *C-20*

RCA R-4

Inoperative

1) "open" first i-f transformer secondary winding
2) "open" or changed value 8,000-ohm resistor in first r-f, oscillator and first i-f cathode circuits. Replace

"Sputtering," Motorboating sound (only at "low" setting of volume control)

1) connect a 0.01-mfd. condenser from the screen-grid circuit to ground

Crackling noise

1) loose eyelet through which grid lead of type '24 tube is brought up, causing a variation in capacity between the grid lead and ground. Remove, or solder eyelet in place
2) faulty volume control
3) peeling condenser plates—burn out peelings with high voltage (all leads disconnected)

(Cont'd)

RCA R-4—*(Cont'd)*

Noisy tuning, Whistling or squealing, Motorboating	1)	corroded condenser-gang rotor contacts. Solder pigtails between rotors and condenser frame
Whistling or squealing		if all voltages and tubes check O.K., check for "open" 8-mfd. cond. *C-16* (in can with several others). Use 500-volt replacement
Distortion	1)	change in value of one or more sections of voltage divider due to carbonization. This will usually *reduce* the plate voltages and *increase* the screen voltages on the r-f, 1st det. and i-f tubes. A 15,000-ohm wire-wound unit may be used from high voltage to screen, and an 8,000-ohm value from here to cathode
Distortion and rattling	1)	recenter the speaker cone

RCA T4-10

Tone quality apparently distorted	1)	due to r-f interference from supply line modulating incoming broadcast signal, causing apparent distortion. Install a 0.006-mmfd. condenser from the 76 rectifier plate to chassis

RCA 5BT

Inoperative at low-frequency end of band	1)	replace 25,000-ohm screen resistor for 1A6 and 1A4 tubes with a 50,000-ohm unit in order to reduce the screen voltage
Cutting off to weak, distorted reception	1)	reduce audio plate voltage by connecting a 4,000 or 5,000-ohm resistor in series with B+ terminal of primary of input audio transformer

RCA QU5

Inoperative on spread-band tuning	1)	if O.K. on A and B bands check for "short" in air trimmer *C-2* connected from band switch to ground
Poor tone	1)	try reversing voice coil leads to 1 speaker
Radio reception breaks through on phono reproduction	1)	remove bus wire connection from between two of the lugs on radio-phono switch and shift the *yellow* lead to the adjoining terminal to which one end of this bus bar was formerly connected

RCA 5Q1, 5Q2

Distortion on 13-meter band	1)	connect a condenser of best value between 0.002 to 0.005-mfd. between the B+ terminal on the oscillator coil and ground

RCA R-5

Poor reception		increase aerial length to about 100 ft.
No control of volume	1)	shield the antenna and r-f coil assembly to prevent direct signal pickup by first r-f coil
Intermittent distortion	1)	check the voltage between the can of the electrolytic condenser, on top of the chassis, and the chassis before and after the distortion occurs. If the voltage *increases* with distortion, one of the resistors shunting the speaker field is defective. The one connected to the low-potential end has a value of 280,000 ohms, while the one connected to the grounded end of the field has a value of 50,000 ohms. To be safe replace both. After this, operate the set for an hour or so to make sure there is no recurrence of the difficulty
Distortion and rattling	1)	recenter the speaker cone

RCA TT-S Television Receiver (Chassis KC-3)

Picture only partial width (about half-size)	1)	"open" condensers *C-81* and *C-82*
Impossible to "center" picture on screen	1)	"open" resistor *R-93* (possibly "open" at soldered lug). Also examine other resistors and condensers mounted on fibre terminal board for broken leads or soldered joints

RCA 5T

Weak reception (all plate and screen voltages low in receiver)	1)	check for "open" 200-ohm resistor *R-16* connected to high-voltage center tap of power transformer. Replace with 10-watt wire-wound unit

RCA T5-2

Intermittent reception	1)	check the soldered leads and lugs inside the i-f coil shields for intermittent "shorting" to the shields. Bend them to provide more clearance to the shields
Noisy reception	1)	replace the 20,500-ohm Candohm (*Cat. No. 4721, R-17, 18, 19, 20*) tapped resistor. Taps in resistor loosen up

RCA 5T8

Distortion on 13-meter band	1)	connect a condenser of best value between 0.002 to 0.005-mfd. between B+ terminal on oscillator coil and ground

RCA 5X, 5X3, 5X4

Weak reception	1)	check for "short" or high-resistance "leakage" between 75 cathode and 43 grid wires at sockets
Whistling or squealing	1)	"open" i-f amplifier cathode by-pass condenser
Pilot light flickers	1)	faulty safety interlock switch in line circuit

RCA C6-2

Same Case Histories as those listed for RCA T6-1 receiver

RCA HF-6

See also Case Histories listed for RCA HF-2 receiver

"Barking" effect on short-waves (due to very abrupt characteristic of fading)	1)	change speed of avc circuits by changing condenser *C-70* from 0.05-mfd. to 0.01-mfd.

RCA 6K

High-pitched whistle, Whooping	1)	replace 0.25-mfd. by-pass condenser (Part *No. 300-36*) in 1st i-f stage

RCA 6K-2, 6G-10

Intermittent cutting off of signal and dial light	1)	small rivet in center of band pilot light "shorting" to ground

RCA O-6

Same Case Histories as those listed for RCA O-2 receiver

RCA QB-6

Same Case Histories as those listed for RCA QB-2 receiver

RCA R-6

Noisy tuning, Whistling or squealing, Motorboating	1)	corroded gang-condenser rotor contacts. Solder flexible pigtails between rotors and condenser frame
Distortion, Erratic operation	1)	change in value of one or more sections of voltage divider (due to carbonization). This has the effect of *reducing* the plate voltages, and *increasing* the screen voltages on the r-f, 1st det., and i-f tubes. A separate 16,000-ohm 10-watt wire-wound unit may be used to replace the section connected in the screen circuit, and a separate 8,000-ohm 3-watt resistor may be used to replace the cathode section

RCA T6-1

Weak reception accompanied by resonance "hiss"	1)	"open" wire-wound pigtail resistor in control-grid circuit of 6A8 det.-osc. tube. ("Open" usually occurs at the lug.) This resistor is employed as the control-grid lead
Hum (at "max." vol. position)	1) 2)	check filter condensers reverse *either* the voice coil *or* the hum-bucking coil leads

RCA T6-2

Inoperative	1)	"shorted" 0.25-mfd. 300-volt cond. *C-32*. Use 500-volt replacement
Noisy reception	1)	"leakage" between resistor No. 11466 (in metal case) and ground

RCA T6-5

Choking, distortion on strong signals	1)	"open" 220,000-ohm AVC resistor in can of 2nd i-f transformer

RCA T6-9

See also Case Histories listed for RCA T6-1 receiver

Fading, Crackling noises	1)	faulty voltage divider. Replace with separate resistor units (3500-13000-85-40-175 ohms)

RCA 6T-10

Same Case Histories as those listed for RCA 6K-2 receiver

RCA 6X-2

Dial pointer loosens	1)	due to expansion and contraction caused by temperature changes. Fasten pointer to molded button shaft with "Du Pont Household Cement"

RCA-Victor 7-11

Same Case Histories as those listed for RCA Radiola 18 receiver

RCA-Victor 7-25

Same Case Histories as those listed for RCA Radiola 17 receiver

RCA 7-26 (Victor Electrola Radiola)

Inoperative (no tubes light, fuses blow)	1)	inspect dry-disc rectifier assembly used to furnish power to the speaker field. Overheating of these stacks indicates that they have lost their rectifying properties, and are passing current in both directions. Install new units

RCA C7-6, D7-7

Inoperative or unstable on all bands	1) 2)	try a new 6A8 tube check to see that *R-5* screen series resistor connected from screen grid of 6K7 i-f amplifier to the ungrounded side of the 10-mfd. condenser *C-22* is 33,000 ohms. If not, replace
Inoperative at low-frequency end of Band "C"	1)	check to see that *R-19* oscillator grid leak connected from 6A8 oscillator grid to ground is 100,000 ohms. If not, replace
Heterodyne whistles	1)	excessive antenna capacity. Reduce size of antenna, or insert a 150-mmfd. condenser in series with antenna lead
"Beat-note" interference from a local station	1)	tune the antenna wave trap to the interference. (The wave trap will tune up to 700 kc).
Radio reception heard during phono reproduction	1)	detection in 1st audio tube. Connect a 250 to 500-mmfd. condenser from 6F5 control grid to chassis to bypass the r-f currents

RCA 7K

Same Case Histories as those listed for RCA 7T receiver

RCA R-7, R-9—Superette

Inoperative	1)	"open" field coil
Weak reception (voltages normal)	1) 2)	faulty a-f transformer (these transf. are in a metal container) receiver out of alignment
Weak reception, Whistling or squealing	1) 2) 3) 4)	decrease in value of 14,300-ohm screen resistor to about 5,000-ohms, causing a high screen-grid voltage. Replace increase in resistance of 8,000-ohm resistor between the screen-grids and the cathodes. Replace with new unit clean the contact springs on the condenser rotor or bond with flexible pigtails to the condenser frame receiver circuits out of alignment
Weak reception (low voltage at all sockets)	1) 2) 3) 4)	"shorted" 100,000-ohm (white and brown) resistor beneath terminal strip "shorted" by-pass condenser across output transformer secondary, (trace out can). Replace with 0.5-mfd. 450-volt condenser check '80 rectifier tube check filter condensers
Distortion, Erratic operation	1) 2) 3) 4)	change in value of one or more sections of voltage divider (due to carbonization). This has the effect of *reducing* the plate voltages, and *increasing* the screen voltages on the r-f, 1st det., and i-f tubes. A 15,000-ohm unit may be used from high-voltage to screen, and an 8,000-ohm value from here to cathode "open" secondary of input a-f transformer strong local station. Interchange the r-f tube with the i-f tube. Shorten the antenna "open" by-pass condensers or connections
Distortion and rattling	1)	recenter speaker cone
Whistling or squealing (all voltages normal)	1) 2) 3)	high-resistance shielding contacts. Clean contacts or bond shields to chassis open-circuited by-pass condensers ungrounded electric light line. Connect the *ground* to both the chassis and ground lead

(Cont'd)

RCA R-7, R-9—Superette—*(Cont'd)*

Whistling or squealing (high screen-grid voltage)
1) change in value of 14,300-ohm screen resistor due to carbonization. Replace with wire-wound unit

Audio howl
1) try new tubes in detector and push-pull stages
2) "open" by-pass condenser
3) if howl develops gradually, it indicates microphonic tubes

Acoustic howl
1) hardened rubber chassis mountings. Replace
2) microphonic tube. Try interchanging second-detector and oscillator tubes
3) loose parts in chassis. Tighten
4) chassis, knobs or shafts touching cabinet. Clear any such contact

Hum
1) faulty '80 tube
2) "shorted" 0.05-mfd. condenser in 2nd det. circuit
3) faulty 1-meg. resistor in 2nd det. circuit
4) "shorted" speaker field coil
5) "open" filter condenser
6) "grounded" or "shorted" by-pass condenser
7) "grounded" heater lead either at the tube sockets or in the transformer

Noisy volume or tone control
1) remove cover and clean resistance element and contact arm

Crackling noises
1) eyelet in chassis through which grid lead to '24 tube is brought up. When eyelet works loose, the capacity of the grid lead passing through it varies with respect to ground. Remove, or solder the eyelet to the chassis

Slipping, or inoperative, dial
1) if a groove has been worn in the rubber friction roller, but not exactly in the middle, proceed as follows: Remove tuning dial, loosen screws holding shaft to chassis, remove roller from shaft and reverse it. Replace dial while holding the shaft and roller firmly down against dial and tightening the shaft-holding screws
2) if rubber friction roller of dial has worn out, remove tuning dial (by loosening its two set-screws) and remove roller from shaft. Cut off a piece of *live* rubber tape (not friction tape) 8½ inches long and ½ inch wide and wrap it tightly around the shaft, in the position of the old roller, layer over layer. The tape will form a new roller

RCA R7-A (A-C)

Distortion
1) change of value of one or more sections of voltage divider (effect will be to *reduce* the plate voltages and *increase* the screen voltages on the r-f, 1st det. and i-f tubes. A 15,000-ohm unit may be used from high voltage to screen, and an 8,000-ohm value from here to cathode

Volume control burns out frequently
1) screen bleeder draws current thru volume control, which overheats it. Transfer bleeder current direct to ground by removing cathode end of the resistor from cathode terminal of i-f tube socket, and solder it to the grounded coil bracket nearby. Then install a standard 10,000-ohm bias control with a 300-ohm minimum bias resistor in series

RCA 7T

Low-frequency stations come in at considerably higher frequency point on dial than they should
1) replace 18-mmfd. condenser which parallels the high-freq. oscillator trimmer

Tuning indicator operates unsatisfactorily
1) changed value of 2.2-megohm resistor *R-20*. Replace

RCA 7T-1

Distortion on 13-meter band
1) connect a by-pass condenser of best value between 0.002 and 0.005-mfd. between B+ terminal of oscillator coil and ground

RCA T7-5

See also Case Histories listed for RCA C7-6 receiver

Distortion (high plate current in 6F6 audio output tube)
1) bias on this tube is too low. Increase the bias resistor to its normal value

RCA 7U-2

Inoperative
1) if there is little or no plate voltage, check for "shorted" 0.25-mfd. by-pass condenser *C-32*. Replace with 600-volt unit

RCA 8BT-6

Intermittent reception, Noisy
1) air-dielectric trimmers "shorted" intermittently by metallic fuzz. "Flash" with high voltage (with all leads disconnected) to burn off the fuzz

RCA C8-15

Intermittent reception
1) if accompanied by strong resonance hiss, check for open-circuiting r-f, 1st det., or osc. coils (usually an "open" at the coil lug)

Distortion
1) if there is no grid voltage on 6F6 tube check for "grounded" electrolytic filter condenser cans. See that connecting lugs of cans clear chassis

RCA CV-8 Pak-O-Powr

Failure to start, Erratic operation
1) erratic action of the vibrator or its failure to function, after the unit has been standing idle for an extended period in the presence of moisture or high atmospheric humidity, may be due to a temporary oxidation of a small spot on one of the primary tungsten contacts. The condition can be readily and satisfactorily rectified by applying 6 volts (instead of normal 4 volts) from a fully charged battery to the vibrator input for approximately 30-60 seconds. To do this, connect the negative (—six volts) of 6-volt battery to the *brown* lead, and the positive (plus six volts) to the *yellow* lead; disconnect seven-contact plug from receiver, and interconnect its terminals *No. 1* and *No. 2* (*yellow* and *white*) so as to close the circuit. Filament leads, *red* and *blue*, should not be attached to battery during application of higher voltage to vibrator. This procedure produces momentary overheating of the contacts, and thoroughly cleans their surfaces so that normal operation results

RCA 8E (PSU)

Circuit changes for improved performance	1)	replace paper condensers, Stock *No. 32049* (C-11 and C-12) on the earlier models with a new type oil capacitor now carried under the same stock number and incorporated in units of later production
	2)	the transformer primary leads should be reversed so that the *black-with-red-tracer* lead goes through R-3 to terminal No. 1 on the vibrator socket and the yellow lead through R-4 to terminal No. 6 of the vibrator socket
	3)	an insulative sheet is to be added to the bottom cover under the 4,700-ohm (R-2) resistor
	4)	precaution should be taken to dress parts and leads to clear chassis and bottom cover. Three ampere fuses are now being recommended for 220-volt operation. They are carried as Stock *No. 10907*.

RCA HF-8

See also Case Histories as those listed for RCA 7-T receiver

Intermittent reception	1)	intermittently "open" 0.01-mfd. 500-volt coupling condenser connected between 6F5 plate and 6F6 grid

RCA 8M Auto Radio

See also Case History listed for RCA 8M1 Auto Radio receiver

Dial slips (due to dial scale rubbing against case)	1)	remove the three nuts which hold dial in place and take dial off dial drive drum Loosen two set-screws on hub of dial drive drum. Move drum as far as possible toward chassis, allowing just enough clearance to prevent its scraping against the two brass screw heads Replace dial and make sure that the dial scale is concentric with the shaft before tightening the dial mounting nuts Mount chassis as far back in case as possible Mount chassis so that dial is centered from left to right with respect to the case If dial scale is loose in its mounting, slightly crimp edge of brass mounting with diagonal cutters See that rubber grommets are in place in shaft holes of case Mount the case end as far forward as possible
Installation suggestion	1)	instead of following manufacturer's instructions, hook the back bolt of the case to the top of the bulkhead (with the strip of metal provided for this purpose) by running this strip perpendicular and tying it to the top of the bulkhead. This will make a more secure job

RCA 8M1, 8M2 Auto Radios

Poor reception, Inability to reach a definite "peak" adjustment on the "antenna compensating condenser"	1)	on a number of cars having built-in antennas of relatively high capacitance, it is frequently difficult to obtain best signal-to-noise ratio, due to improper matching of the antenna system to the input. This is particularly true where the insulated steel top insert, running board, or rear trunk is employed as antenna. Improved performance can be obtained by changing the value of the antenna series capacitor *C-1* from 680-mmfd. to a value of 300-400 mmfd. Correct matching is indicated by ability to reach a definite peak adjustment on the "antenna compensating condenser"

RCA 8M3 Auto Radio

See also Case History listed for RCA 8M1 Auto Radio receiver

Inoperative, Intermittent reception	1)	the plating on the adjustment screws of the antenna trimmer *C-3* may become chipped, and will cause the trimmer to be short-circuited. In order to correct this condition, remove the screw entirely, see that the metallic chips are cleaned from the trimmer plates, and clean the burrs from the threads of the screw. Replace the screw and readjust the trimmer at 1400 kc as directed in the manufacturer's service sheet
Noise	1)	secure contact is required between vibrator transformer and chassis in order to minimize internal noise induction
	2)	in early-run receivers, connect the 22-mmfd. antenna shunt condenser *C-1* between the output end of the antenna filter coil *L-1*, instead of between the antenna end and the chassis as shown in the schematic diagram

RCA 8M4 Auto Radio

See also Case History listed for RCA 8M1 Auto Radio receiver

Fuse blows when receiver is installed in car	1)	insufficient tension of vibrator reed causes it to "short" to live reed. Replace
Noise	1)	secure contact is required between vibrator transformer and chassis in order to minimize internal noise induction
	2)	in early-run receivers, connect the 22-mmfd. antenna shunt condenser *C-1* between the output end of the antenna filter coil *L-1*, instead of between the antenna end of the chassis as shown in the schematic diagram
Vibrator noise interference, Hum interference	1)	noise or hum interference may develop when the local-distance switch is operated in the local position, if there are poor grounds at the car battery or insecure contact between various members of the car chassis. The interference can be eliminated by installing a 500-ohm resistor (preferably a flexible pigtail type) in series with the *black* lead to the local-distance switch on the control-head assembly

RCA 8QU5C

Improving phono compensation circuit	1)	change phono compensation condenser *C-51* from 0.015-mfd. to 0.035-mfd. (Stock *No. 5196*) and shunt this with an 82,000-ohm resistor (Stock *No. 14023*)

RCA R-8

Inoperative on low-frequencies (oscillator fails to function)	1)	40,000-ohm resistor connected from oscillator control grid to cathode has lowered in value due to carbonization. Check resistance value, and replace if necessary
Inoperative until AVC tube is withdrawn, Fading, Weak reception	1)	"leaky" 0.1-mfd. AVC grid-return bypass condensers

(Cont'd)

RCA R-8—*(Cont'd)*

Intermittent reception, Whistling or squealing, Weak reception	1)	"open-circuiting", or "open", r-f and i-f secondary return by-pass condensers
	2)	"open" 4-mfd. condenser *C-14* by-passing plate of 27 oscillator tube
	3)	replace resistor *R-4* with a 15,000-ohm 5-watt unit. Replace *R-1* with an 8,000-ohm 1-watt unit
	4)	clean and adjust tension of contact springs on tuning condenser rotor. Re-align entire receiver
Intermittent fading	1)	see if pushing or pulling on the control knob causes the trouble to appear (try this at different settings). If it does, replace the control
Weak reception, Crackling	1)	faulty "primary" in first a-f transformer (the two audio transformers are sealed into a single can, with no room left to mount another). Re-wire to resistance coupling, substituting a 100,000-ohm resistor for the primary and 30,000-ohms for the secondary, coupling the detector plate to the audio grid through a 0.05-mfd. mica condenser
Weak reception, (low plate and screen current in 47), Hum	1)	"open" 100,000-ohm resistor which connects between grid return of 47 tube and ground
Distortion at any volume	1)	carbonized voltage-divider resistors (install wire-wound resistors)
Noisy tuning, Whistling or squealing	1)	corroded condenser-gang rotor contacts. Solder flexible pigtails between rotors and condenser frame
Motorboating sound	1)	defective 4-mfd. pack condenser in the plate-to-ground circuit of the r-f and detector-oscillator plate voltage filter. Replace this condenser on the outside of the pack
Slipping dial	1)	if rubber ring on dial drive assembly slips on shaft, make a thin metal washer the size of the rubber ring. Slip washer over shaft and hold in place by a small pin through shaft and soldered to washer. Then pin ring to washer

RCA 8T

Intermittent reception	1)	intermittently "open" 0.01-mfd. 500-volt coupling condenser connected between 6F5 plate and 6F6 grid
Unsatisfactory tuning eye operation	1)	replace 2.2-megohm resistor *R-20*

RCA T8-4

Same Case Histories as those listed for RCA C8-15 receiver

RCA T8-13

Distortion	1)	check audio coupling condensers for "leakage" between the two terminals and also between each terminal and the metal case

RCA T8-14, T8-16

Whistling or squealing	1)	grid leak on rear top of main tuning condenser has changed value. Replace

RCA T8-18

Inoperative, Weak reception, Noisy	1)	if "click" is heard when power tube is removed, and the first a-f stage appears "dead," check plate voltage on same. Check for a "leaky" or "shorted" by-pass condenser. Replace with mica unit

RCA-VICTOR 9-16

Same Case Histories as those listed for RCA Radiola 18 receiver

RCA-VICTOR 9-18, 9-54

Inoperative below 600 kc, Dial settings incorrect	1)	snapped tabs on oscillator series condenser
Intermittent reception	1)	snapped tabs on oscillator series condenser
Insensitive at either high or low frequencies	1)	oscillator trimmers out of adjustment
	2)	r-f compensator condenser out of adjustment
Weak reception, No control of volume	1)	open-circuited 1-megohm AVC grid resistor
Distorted, Weak	1)	open-circuited audio transformer primary
Tuning meter fluctuates	1)	shunt 0.001-mfd. condenser across meter

RCA C9-4

See also Case Histories listed for RCA C8-15 receiver

Inoperative, Intermittent reception	1)	if all voltages and tubes check O.K., try a new 6L7 tube

RCA D9-19

See also Case Histories listed for RCA C8-15 receiver

Weak reception (tuning eye does not function, second i-f trimmer will not "peak," all voltages check O.K.)	1)	oil dripping from phono motor has soaked into the trimmers, thus changing their capacity. Clean trimmers thoroughly, and realign the receiver. Use oil sparingly on motor

RCA 9K

Inoperative (all bands)	1)	if there is no voltage on r-f and i-f tube screens, check for "open" 22,000-ohm section in voltage-divider resistor unit. Replace with 20-watt wire-wound unit
Inoperative below about 600 kc	1)	replace small 0.0001-mfd. condenser on top of condenser gang and connected to grid of 6J7 oscillator tube
One band "dead"	1)	this receiver has a 5-band dial but only four positions of the band switch. A stop is provided to eliminate the "dead" position. This should always be in place when the set leaves the shop otherwise a complaint of one "dead" band might be received
Intermittent reception	1)	loose contacts on band switch—especially the contact with the *blue* r-f coil lead. Tighten the contact springs

RCA 9K1

Inoperative below about 600 kc	1)	replace small 0.0001-mfd. condenser on top of condenser gang and connected to grid of 6J7 oscillator tube
Intermittent operation (tuning eye operates even though set cuts off)	1)	replace 0.01-mfd. audio coupling condenser between plate of 6F5 and grid of 6F6 tube. Use a 600-volt unit

RCA 9K2

Inoperative (oscillator not functioning)	1)	check 10,000-ohm resistor *R-10* connected to pin *No. 4* of Magic Brain Socket
Intermittent reception (operation restored if set is jarred)	1)	replace audio coupling condenser between 6F5 and 6L6 tubes with a 0.1-mfd. 600-volt unit
Poor reception on broadcast band		if s.w. reception is O.K., replace screen resistor for 6L7 tube
Repeated failure of 6L6 and 5Z4 tubes, power transformer and overheated electrolytic condensers	1)	if 6L6 grid has a *positive* bias, check for "leaky" audio coupling condenser in 6L6 grid circuit
Noisy reception	1)	resolder all connections on 6F5 socket

RCA 9K3

Inoperative on s.w. band	1)	33,000-ohm grid leak of 6J7 oscillator has increased in resist.
Choked, intermittent reception	1)	check condenser pack containing condensers *No. C-38, C-39, C-40*
	2)	check for high-resistance leakage between cathode and filament of 6H6 tube
Repeated failure of 6L6 and 5Z4 tubes, power transformer and heated electrolytic condensers	1)	if 6L6 grid has a *positive* bias, check for "leaky" audio coupling condenser in 1L6 grid circuit
Improving audio response	1)	add a 25-mfd. low-voltage electrolytic condenser to cathode circuit of the 6L6 tube

RCA 9K10

Same Case Histories as those listed for RCA 9K2 receiver

RCA 9M Auto Radio

See also Case Histories listed for RCA 8M Auto Radio receiver

Installation suggestion	1)	instead of following manufacturer's instructions, hook the back bolt of the case to the top of the bulkhead (with the strip of metal provided for this purpose) by running this strip perpendicular and tying it to the top of the bulkhead. This will make a more secure job

RCA 9M1, 9M2 Auto Radios

Audio "buzz"	1)	connect 0.005-mfd. condenser that is normally connected between 6F6 output tube plate and ground, across the output transformer primary
Installing a tone control	1)	connect a 0.05-mfd. condenser in series with a 15,000-ohm variable resistor in place of this output by-pass condenser. Shield all leads to the variable resistor
Reducing battery drain of receiver	1)	use a type 6K6GT or 6K6G tube in output socket and a type OZ4G rectifier. No circuit changes are required other than to make sure the 6A7 grid lead is dressed as far away as possible from 6K6G tube to avoid audio regeneration. This reduces battery drain by 0.9 amps
Preventing damage to tuning assembly	1)	it is very important that the caution given in the manufacturer's instruction sheet relative to tightening the push-button screws be observed. Forcing the adjustment screw past its normal stop will cause damage to the tuning assembly

RCA R-9

See also Case Histories listed for RCA R-4, R-6, R-7, R-8 receivers

Whistling or squealing	1)	"dried out" electrolytic filter pack. Replace
	2)	install grounded tube shields on the W-27 tubes if they do not already have shields
	3)	i-f stages peaked too sharply. Put tube shields on the '27 tubes, or slightly flat-top the i-f adjustments
Hum	1)	"dried out" electrolytic filter pack
Noisy volume control	1)	replace with improved type *No. H-25486* or *No. 5-MRT*
Noisy—sounds like bad static	1)	if this persists even when oscillator tube is removed, check for noisy i-f transf.
Noisy reception, (disappears when set is tapped)	1)	tighten bolt (located between type '35 i-f tube and type '24 first detector tube) which holds oscillator coil in place and also provides a "ground" for it

RCA R-9A

Same Case Histories as listed for RCA R-7A receiver

RCA 9SX "Little Nipper"

Hum, Buzzing noise	1)	insufficient filtering. Connect a 2-mfd. 400-volt filter condenser between rectifier plate and chassis
Burned out pilot lamp and shunt resistor	1)	if receiver contains a 35Z40 tube replace it with a 35Z5 and connect pilot lamp terminals across the tube pin terminals designed for the pilot lamp. Shunt resistor need not be replaced

RCA 9T

Poor reception on broadcast band (O.K. on short-waves)	1)	replace screen resistor for 6L7 tube
Repeated failure of 6L6 and 5Z4 tubes, power transformers and overheated electrolytic condensers	1)	if 6L6 grid has a *positive* bias, check for "leaky" audio coupling condenser in 6L6 grid circuit

RCA T9-7, T9-8

Weak reception	1)	it is essential that the "C" Band be properly aligned in order to obtain maximum sensitivity on this receiver. Special care should be exercised to make sure that the oscillator stage is aligned 460 kc below the signal frequency on this band—in accordance with the service instructions
Erratic reception, intermittent hum	1)	check 25Z6 rectifier tube and 16-mfd. condenser *C-41*. Replace the 25Z6 tube with a 25Z6-G tube (no wiring changes required) for better performance
Improving performance of early-run T9-8 receivers	1)	connect a 0.25-mfd. condenser from junction of *R-15* and *R-16* to the common ground connection

RCA TRK-9 Television receiver

One side of picture tears away	1)	microphonic 6L6 horizontal output amplifier tube. Replace with special television type 6L6 having three wafers at base
Shading in picture reversed	1)	changed value of 3300-ohms 1852 video amplifier plate load resistor *R-57*. Replace with 3500-ohm 2-watt metallized resistor (do not use a wire-wound or any type of inductive resistor)

RCA 9TX Series

Fading intermittently	1)	intermittent "open" in 0.01-mfd. tubular condenser connected between grid of 6SQ7 tube and rotating arm of volume control. Install replacement unit so no strain will be put on its connecting leads

RCA 9TX-31, 9TX-32, 9TX-33

Weak reception and distortion	1)	"leaky" 20-mfd. filter condenser following rectifier
Line resistor and pilot light burn out frequently	1)	make the following circuit changes: (a) Remove all connections from terminals No. 2 and No. 4 of terminal board and terminals No. 2, No. 5, and No. 6 of 35Z4GT socket. (b) Resolder pilot lamp lead, removed from terminal No. 4 of terminal board, and power lead removed from terminal No. 6 of rectifier socket, to terminal No. 2 of rectifier socket. (c) Resolder pilot lamp lead, removed from terminal No. 6 of rectifier socket, to terminal No. 3 of rectifier socket. Add jumper between No. 5 and No. 3 of rectifier socket. (d) Resolder 0.05-mfd. capacitor, removed from terminal No. 6 of rectifier socket, to terminal No. 5 of rectifier socket. (e) Replace jumper between terminal No. 7 of rectifier socket and terminal No. 2 of 35L6GT socket, with an 86-ohm resistor (Stock *No. 33558*). (f) Replace 35Z4GT rectifier tube with a 35Z5GT rectifier tube. (g) Replace No. 47 Mazda pilot lamp with a No. 51 Mazda pilot lamp (Stock *No. 11765*).
	2)	replace 24-ohm pilot shunt resistor with 25-ohm 10-watt unit

RCA 9U

Distortion	1)	"leaky" or "shorted" 20-mfd. 6L6 output tube cathode by-pass condenser

RCA U9

Howling at high-volume levels	1)	microphonic 12SA7 tube. Replace
Distortion	1)	check 50L6GT output tube for internal leakage

(Cont'd)

RCA U-9—*(Cont'd)*

Distortion on phono only	1)	inspect tone arm for tilted mounting. Correct it
Phono turntable wobbles	1)	true up turntable in following manner: (a) Obtain a motor bearing, Stock *No. 31046* (used in R93-B) and clamp it securely in a vice (b) Place turntable spindle in this bearing and make sure that turntable spins freely (c) With turntable spinning, the "high" side can readily be determined by use of a piece of chalk carefully lowered so that it just touches the high spot of the turntable, leaving a mark (d) With both hands, grasp the rim of the turntable, with thumbs on top and index fingers underneath turntable at center of chalk mark (e) Apply a moderate amount of pressure in a downward direction at right angles to the jaws of the vice (f) Spin turntable again and if it still wobbles, repeat the operation mentioned under (c), continuing by trial until the turntable runs true

RCA BP-10 "Personal"

Weak reception in models having elliptical type speaker	1)	1S4 output tube too close to speaker magnet, causing disturbance of the space charge in the tube. Install a felt pad between speaker frame and the tube to keep the tube upright in its socket and spaced away from the magnet
Flashlight cells have short life and reception is distorted	1)	check to see if A+ lug of switch "grounds" to metal case. Insulate by placing adhesive tape on the case. Also insulate A leads to battery holder. Make sure flashlight cell is placed in holder properly—if it is placed backwards, the polarity and bias will be reversed, and distortion will result.
Loose control knobs	1)	remove loose control knob from shaft and scrape off all old cement from both knob and shaft. Apply a coat of a good cement (G. E. Themoplastic cement ZV-5057 is excellent for this) to the portion of shaft which is to engage the knob. After cement has air-dried, apply a small amount of heat to shaft to soften the cement. Mount knob on shaft while cement is still soft, and allow a few minutes for drying

RCA 10K

Inoperative	1)	replace 470,000-ohm grid resistor in 6L6 output tube circuit with 300,000-ohm ½-watt unit
Weak reception on all bands	1)	check bias switch S-7 (operated by waveband switch) to see if it sticks at any one position when turned clockwise. Clean contact points and lubricate
	2)	if screen voltage is more than 95 volts, check for faulty Cardohm bleeder resistor unit mounted under chassis
Intermittent reception (possibly at long intervals)	1)	loose contacts on band switch—especially the contact with the *blue* r-f coil lead. Tighten the contact springs

RCA O-10

"Waver" or "wow" in phono repro	1)	see remedy for this Trouble Symptom listed under RCA 0-2 receiver

RCA R-10

Fading	1)	faulty r-f choke in detector circuit
	2)	faulty output transformer
Whistling, Noise, Distortion	1)	"gassy" 35 r-f or i-f tubes. Try replacing all these tubes, one at a time
	2)	clean and adjust contact wipers on gang condenser
	3)	carbonized 160,000-ohm screen resistor. Replace with wire-wound type

(Cont'd over)

RCA R-10—*(Cont'd)*

Noisy operation	1)	check for loose metal grommet through which passes the control-grid wire to the '24 1st detector. Solder it to chassis, or tighten securely
Noisy volume control	1)	replace volume control to eliminate noise
Volume control will not reduce signal to low value	1)	"open" 0.05-mfd. condenser in grid return of 2nd detector. Replace

RCA 10T

Same Case Histories as listed for RCA 10K receiver

RCA T10-1

Receiver "cuts off"	1)	disconnect *green* wire fron volume control. Connect a 30,000-ohm resistor (original was 27,000 *R13* on RCA diagram) from this volume control tap to a 0.015-mfd. condenser, connecting the other terminal of the condenser to the ground. Disconnect the *yellow* wire from the other volume control tap and connect a 9,000-ohm resistor (original 8,200) to the tap, connecting the other end to a 0.05-mfd. condenser and connecting the other end of the condenser to the chassis ground. Connect the mid-point of this condenser-resistor setup to the "music-speech" switch by removing *blue* wire
Repeated trouble with "open" a-f transformer windings	1)	when replacing a-f transformers, use a parallel-feed plate circuit arrangement employing a 30,000-ohm resistor and a 0.25-mfd. condenser

RCA U-10

Phono turntable wobbles	1)	see remedy for this Trouble Symptom listed under RCA U-9 receiver

RCA 10X

Hum	1)	dress heater wiring leads away from audio input circuit

RCA C11-1, D11-2

Inoperative on short-wave bands	1)	if oscillator tube checks O.K., replace the small fixed condenser *C-50* in series with the oscillator tube grid and the tuning condenser
Receiver "cuts off"	1)	disconnect *green* wire from volume control. Connect a 30,000-ohm resistor (original was 27,000 *R13* on RCA diagram) from this volume control tap to a 0.015-mfd. condenser, connecting the other terminal of the condenser to the ground. Disconnect the *yellow* wire from the other volume control tap and connect a 9,000-ohm resistor (original 8,200) to the tap, connecting the other end to a 0.05-mfd. condenser and connecting the other end of the condenser to the chassis ground. Connect the mid-point of this condenser-resistor setup to the "music-speech" switch by removing the *blue* wire
Intermittent operation	1)	replace audio coupling condenser at the front right end of dial (looking down on top of chassis)

(Cont'd)

RCA C11-1, D11-2—*(Cont'd)*

Violent change in volume when "speech-music" control is varied	1)	"open" tone-control compensating condensers (usually difficult to isolate on account of the resistor network in the circuit). Replace entire new condenser pack *No. 11318*. This pack contains condensers *C-25, C-28* and resistors *R-12, R-13*. This condenser pack is located on the front of the chassis, and connects to both the volume and the "speech-music" controls

RCA O-11 Phono Motor

Crackling noisy reception	1)	high-resistance joint in detector coil circuit —check joints at coil lugs especially
Mechanical noise during operation	1)	to reduce the mechanical noise loosen the two screws which hold the governor shaft bearing and adjust the eccentric bearings so as to obtain a desirable running clearance between the worm and gear. As this adjustment is made, you will readily notice that the noise is affected to a considerable extent
Adjusting governor for speed control	2)	the proper method of adjusting the governor is in the setting of the felt brake or the sliding of the governor into the desired position on the shaft. There is a set-screw in the governor collar which holds the governor securely to the shaft and this must be loosened before the governor can be moved in either direction.
Lubricating	3)	the points of lubrication are between the bearings and shafts of gears. Although no oiler is provided, it is advisable to introduce a drop or two of 10W oil between the bearings and shafts. The speed variation is caused by an incorrect setting of the brake felt or of the governor and this is fairly well covered above. The graphite grease in the spring barrel occasionally causes a variation in speed and this is overcome usually by winding the motor and letting it run down once or twice. The graphite grease seldom affects the speed after a motor has been in use for some little time

RCA R-11

Inoperative	1)	"open" in one of the second i-f transformer windings
	2)	if operation of the receiver is restored when the AVC tube is removed from its socket, replace the 0.1-mfd. AVC grid-return by-pass condenser as it has leakage which in effect over-biases the tubes which are AVC controlled, making the set inoperative
Intermittent reception Fading, Noisy reception	1)	replace the 0.1-mfd. condenser *C-18* in the AVC network. This unit is located in the condenser pack and can be located by the *white* lead that goes through the resistor board
	2)	for almost certain cure of these troubles, remove entire filter block (which also houses the filter and avc by-pass condensers) and replace them with individual high-grade condensers
	3)	volume control shaft contact corroded
	4)	loose resistance winding on volume control
Intermittent reception after the '27 AVC tube is replaced	1)	due to excessive heat developed in tube as a result of small-sized envelope. Replace with old type '27 straight-sided envelope tube
Intermittent reception, Motorboating sound	1)	replace the 5-megohm and 1-megohm resistors in the grid circuit of the '27 AVC tube. If this does not clear up the trouble, try replacing the 40,000 and 190,000-ohm resistors which are in series with each other and shunt the speaker field

(Cont'd)

RCA R-11—*(Cont'd)*

Signal cuts off, with only strong locals heard	1)	"leaky" by-pass condenser connected from second detector plate to cathode. Replace with mica condenser
Weak reception, Distortion, Fading (about 15 minutes after set is switched on)	1)	leaky 5-megohm carbon resistor in the AVC circuit, connecting to the grid of the '27 AVC tube. Replace with a new unit
	2)	replace the '27 AVC tube
	3)	"open" coupling winding in 2nd i-f transformer
	4)	"leaky" 0.1-mfd. condensers in grid return of '27 AVC tube
Fading after normal operation for about 10 minutes to 1 hour. Normal operation is resumed if AVC tube is withdrawn	1)	filament voltage on AVC tube too low
	2)	high-resistance leak in the condenser connected between the two 1-megohm resistors in the grid circuit of the '27 AVC tube
	3)	defective 5-megohm resistor from the grid circuit of the '27 AVC tube. Replace with a 2- or 3-megohm unit
	4)	leaky blocking condenser from the plate of the type '35 tube to the grid of the AVC tube
	5)	leaky condenser connected between cathode and plate on the '27 AVC tube. Replace with new unit
No AVC action	1)	replace '27 AVC tube
	2)	decrease in value of one of the resistors in the AVC network
Stations tune in with a "plop"	1)	reduce AVC tube heater voltage
Whistling or squealing (all receiver circuits are correctly aligned)	1)	decrease in capacity of condenser connected across rectifier output. Replace
	2)	dirty or corroded condenser rotor contacts. Solder flexible pigtail leads between the rotors and the condenser frame or chassis
	3)	"leaky" 9-mmfd. condenser feeding grid of the '27 AVC tube. Replace
Distortion at low volume	1)	primary-secondary "short" in push-pull input transformer
Distortion on powerful locals (AVC system does not generate sufficient voltage to keep r-f from overloading the detector)	1)	connect a 2-megohm resistor between junctions of resistors *R-10* and *R-11* and *R-16* and *R-17*
Distortion at any volume level	1)	carbonized voltage-divider resistors. Install wire-wound unit for screen-drop resistor
Distortion, Weak reception, (high positive bias on one output tube)	1)	primary to secondary "short" in push-pull input transformer
Noisy tuning, Whistling or squealing	1)	corroded condenser-gang rotor contacts. Solder a pigtail from rotor shaft to chassis
Motorboating sound	1)	connect a 0.1-mfd. condenser across the resistor mounted inside of the ant. coil
	2)	"leaky" by-pass or filter condensers contained in a common can. It is usually advisable to replace the entire can

(Cont'd)

RCA R-11—*(Cont'd)*

Motorboating sound —*(Cont'd)*	3	"open" by-pass condenser in cathode circuit of pre-selector circuit or 1st detector
	4)	incomplete grounding of rotor section of gang condenser. Install pigtails
	5)	incorrect alignment of receiver tuned circuits
Hum (either steady or intermittent)	1)	1-megohm carbon resistor connected between terminal *No. 6* on the resistor board and terminal *No. 3* on the rear phono-pickup terminal board short-circuiting to terminal *No. 4*. Insulate this resistor from terminal *No. 4*. (*Note*: the faultiness of the above resistor is easily detected by short-circuiting terminal *No. 3* to *No. 4*. If the hum remains unchanged and motorboating is apparent when the type '47 tube behind the type '80 tube is withdrawn, then the resistor is defective)

RCA 12Q4, 12QK, 12QU

Hum or low-frequency interference when tuned to short-wave station on the spread bands	1)	if condition is accentuated by slight detuning of the station to one side of the carrier, remove the small bus lead which joins the *shield* and *heater* terminals on the 6J7 oscillator tube socket. Install a short lead between the *heater* contact and side of chassis. Do not disturb any other leads when making this change, or it may become necessary to readjust the 19 and 25-meter oscillator trimmers to restore proper dial calibration

RCA R-12

See also Case Histories listed for RCA R-8 receiver

Weak reception (usually accompanied by low plate and screen current on 47), Intermittent hum	1)	"open" 100,000-ohm resistor connected between grid-return of the '47 tube and ground
Whistling or squealing	1)	check various by-pass condensers in set for "opens" by bridging them with a 1-mfd. unit
	2)	check 4-mfd. oscillator plate by-pass condenser for "open" (this also bypasses the screens of the 1st r-f, 1st detector and i-f tubes)
Distortion (incorrect grid and plate voltages on '47 tube)	1)	bleeder resistors changed value. One is a 16,000-ohm unit connected from screens to ground. The other is an 8,000-ohm unit. If values vary over 10 per cent from these figures, replace them
Motorboating sound	1)	faulty '47 tubes. Check them
	2)	connect a 5,000-ohm resistor in series with the screens of the 47 tubes to prevent recurrence of the trouble

RCA U-12

Phono turntable wobbles	1)	see remedy for this Trouble Symptom listed under RCA U-9 receiver

RCA C13-2

Violent change in volume when "speech-music" control is varied	1)	see Case History for this trouble listed under RCA C11-1 receiver

(Cont'd over)

RCA C13-12—*(Cont'd)*

Intermittent reception	1)	replace audio coupling unit at front right end of dial (looking down on top of chassis)
Hum	1)	"open" 8-mfd. a-f plate by-pass condenser. Clip *red* lead, and replace with 250-volt unit
Distortion, No avc action	1)	check 0.05-mfd. condenser *C-29* connected from low end of second i-f coil in the avc lead to ground

RCA 13K

Magic eye inoperative (lights up but no action)	1)	movable arm of tuning tube control "shorting" to metal cover. Take apart and bend arm until it clears
Fuse blows, Erratic operation	1)	inspect for "short" caused by leads to upper pilot lights on Magic Brain rubbing against tuning condenser drive gear. Bond these leads clear of the gear
	2)	intermittent "shorts" between elements in the 5Z4 tubes, caused by speaker vibrations
Fading after several hours of operation	1)	check for "open" 10-mfd. filter condenser *C-85* or *C-86* (connected in parallel)
Motorboating sound, Distortion (continuous or intermittent)	1)	"open" joint in the 10-10 mfd. condenser unit used as a by-pass for the audio and driver stage cathodes. Use Part *No. 13025* for replacement

RCA 14BK, 14BT1, 14BT2

Weak reception, Distortion	1)	if due to frequency drift in receiver circuits proceed as follows: (a) connect a 9-mmfd. condenser (Stock *No. 37814*) from "high" side of oscillator section at gang condenser to ground (b) realign 1st det. and oscillator tuned circuits (c) realign i-f circuits if necessary
Excessive regeneration	1)	make certain that grounding finger for 1N5GT tube shield is fastened to tube pin No. 1, which is grounded to receiver chassis. Make certain that metal rim of 1N5GT socket is soldered to chassis. Realign i-f transformers stage by stage. Replace any unusually high-gain 1N5GT or 1A7GT tubes with tubes having normal gain

RCA O-14

"Waver," "wow" on phono	1)	see remedy for this Trouble Symptom listed under RCA 0-2 receiver

RCA Q-14

Weak, Distortion	1)	"leaky" 330-mmfd. mica condenser bypassing 6SQ7 plate

RCA 15 BP

Tube filaments burn out frequently	1)	due to excessive voltage surges occuring when switching from "Power Line" to "Battery," or vice versa. Replace power switch with new type (using Stock *No. 37393* kit which includes 5-ohm resistor and a new indicator) wired as per directions. New switch passes through "OFF" position in going from "Power Line" to "Battery," thereby discharging all filter condensers
Hum	1)	shield 1H5GT 2nd det.-1st a-f tube by means of a tube shield securely grounded. Add a filter network (com-

(Cont'd)

RCA 15 BP—*(Cont'd)*

Hum —*(Cont'd)*		posed of a 100,000-ohm resistor by-passed to ground by a 0.1-mfd. condenser) in the B+ end of the plate-return circuit of this tube
To accentuate the higher audio frequency reproduction	1)	change 390-mmfd. condenser *C-15* connected across 1st a-f output to a 100-mfd. unit. (Some productions already have this change made at factory)
Dial cord slips	1)	take an extra turn of cord around the drive shaft without lengthening the cord, thus securing better grip and increased spring tension

RCA C15-3

Inoperative on Band "D"	1)	change in position of wiring, which forms the r-f transformer for this particular band
Intermittent reception	1)	replace audio coupling unit at front right end of dial (looking down on top of chassis)
Violent change in volume when "speech-music" control is varied	1)	see Case History for this same trouble symptom listed under RCA C11-1 receiver
Hum	1)	shift in position of one of the audio components. It is necessary that every audio part in the set should be in exactly the same position as it was placed in the factory
Rough reproduction and occasional "cutting-out" at low volume	1)	replace volume control with an RCA 5-terminal unit
Distortion (zero or low grid bias on 6F6 output tubes and tube elements overheating)	1)	"leaky" or "shorted" condenser *C-73*

RCA 15K

See also Case Histories listed for RCA 13K receiver

Erratic reception	1)	if receiver contains combined tone control and "Hi-Fi" switch, check this switch control
Intermittent reception	1)	check for "intermittently open" or "shorted" speaker voice coil
Loud hum	1)	if plate voltage is low, check for "open" 10-mfd. filter condenser *C-87*, or *C-88*. Replace with units of larger capacity
Tuning eye inoperative	1)	"short" between tuning tube control movable arm and metal cover due to small clearance. Take control apart and bend arm so it clears

RCA-Victor R-15

Inoperative (no r-f screen voltage)	1)	"open" r-f choke in screen circuit
Intermittent operation, Low volume, Whistling or squealing	1)	clean gang condenser rotor wipers
	2)	poor contact of coil and tube shields with chassis. Clean thoroughly
	3)	chassis not in proper position in cabinet, causing condenser gang to "short" (chassis of this receiver is very flexible)
	4)	faulty dual volume control. Replace

(Cont'd)

RCA-Victor R-15—*(Cont'd)*

Weak reception (positive bias on '45 tubes)	1)	"shorted" or "leaky" 0.025-mfd. audio coupling condenser
Whistling or squealing	1)	clean gang condenser rotor wipers
	2)	poor contact of coil and tube shields with chassis. Clean thoroughly
Noisy tuning	1)	plating peeling from gang condenser plates. Burn out with high voltage — (all leads disconnected)
	2)	clean all rotor wiper contacts
Noisy operation	1)	broken resistance elements in dual volume control. Replace
Distortion	1)	"shorted" or "leaky" 0.025-mfd. audio coupling condenser
Distortion and noise when volume control is adjusted	1)	replace volume control. Before removing unit, make a sketch of connections. The screen-grid section on the new control has a different value and a reverse taper, so when it is installed the two outside connections on the screen portion should be *reversed*, and the 12,000-ohm *gray* resistor connected across it should be removed
Hum	1)	try new '24 detector tube

RCA VA-15

Binding or "hesitation" of tone arm in record changer	1)	small burr on edge "E." Carefully remove burr with a fine file until edge is entirely smooth.
	2)	binding of Pin 4 between edges "E" and "F." File off edge "F" with a fine file to give just enough clearance for smooth operation.
	3)	too far an outward swing of the Pickup Arm. This causes Pin 4 to be caught in the upper curved portion of edge "F." On some models the Pick-up Arm Shaft can be rotated by loosening the nut under the motor board. Rotate sufficiently to prevent Pin 4 from riding into curved portion mentioned, when Pick-up Arm is in the outermost position. On models where the Pick-up Arm Shaft is positioned by a locating key, it is necessary to bend Stop Guide "S" on Pick-up Arm towards Stop Ear "P" on Pick-up Arm Shaft so that the condition mentioned in the above paragraph is obtained.
Loosening of mounting studs on which the main lever, cam-and-gear, or trip pawl are pivoted	1)	may be caused by jamming of the main lever against the pawl pin at the end of the change cycle due to one or more of the following reasons: (a) The long arm of the main lever slides over the thin pawl pin instead of pushing against it during first half of cycle. Check for bent arm on main lever. (b) After being cleared out of the way, the trip pawl bounces back due to vibration (dancing near mechanism, etc.) Check the trip-pawl phosphor-bronze spring for sufficient "drag" or pressure against the pawl. (c) The index lever is put into "REJECT" position while the mechanism is still in its change cycle. Caution customer against this. Loose studs may be quickly and easily replaced by using special replacement studs that are fastened to the motorboard by means of a screw and washer. Three different studs are available

RCA 15X

Hum	1)	if receiver has a common ground return made to a lug on the power switch, remove the grounding lead, between the volume control and the power switch, and connect it directly from the same volume control lug to the chassis

RCA O-16

"Waver" or "wow" in phono reproduction	1)	see remedies for this Trouble Symptom listed under RCA 0-2

RCA 16K

Fails to oscillate on p.b. tuning	1)	check oscillator grid leak to assure that it is 56,000 ohms. If it is a 33,000-ohm unit, change to 56,000 ohms
To obtain reception in the 2,400 kc police band	1)	add a jumper connection from trimmer *C-3* to trimmer *C-40*, and line up push-button *No. 5* to the desired police station. Realign *C-3* at 1,500 kc.
To increase sensitivity of receiver in rural locations	1)	change r-f plate load resistor to a higher value between 6,000 and 10,000 ohms. Do not make this change in a metropolitan district because of the possibility of cross-modulation

RCA Q-16

"Flutter"	1)	if set has "electrodynamic" speaker, change 0.0025-mfd. audio coupling condenser *C-25* to 0.0015-mfd.
Improvement	1)	change *C-33* from 18 to 15 mmfd.

RCA RADIOLA 16

Inoperative	1)	if '71A plate voltage is zero, check for "open" voltage divider in power unit
Weak reception	1)	if no grid voltage on one r-f tube, check for "open" grid resistor
Weak reception (dial calibration shifted)	1)	gang condenser bearings worn. Move gang condenser stators so that rotor and stator plates are evenly spaced
Noisy on all stations	1)	if check shows that trouble is not due to outside noises, check for noisy phone condenser or audio transformer
Whistling or squealing	1)	connect a 600-ohm resistor in series with *red* 135-volt B+ lead
Audio howl	1)	connect 250,000-ohm resistor across first a-f transf. secondary
Hum	1)	corroded resistance windings on hum-adjusting potentiometers in power unit

RCA RE-16

Whistling or squealing	1)	connect a 600-ohm resistor in series with *red* 135-volt power pack lead
Howling	1)	microphonic tubes
	2)	"open" by-pass condenser connected across secondary of first a-f transf. If unable to obtain a replacement, remove "open" condenser from circuit, and connect a 0.00025-mfd. fixed condenser from grid of 1st a-f tube to chassis
Noisy	1)	faulty grid suppressor resistor. The first one has value of either 600 or 1,000 ohms; 3rd r-f stage unit is 1,000 ohms

RCA 16T-2, 16T-3, 16T-4

Same Case Histories as those listed for RCA 16K receiver

RCA 16X-1, 16X-2, 16X-3, 16X-4, 16X-11, 16X-13, 16X-14

Same Case History as that listed for RCA 15X receiver

RCA 17K

Same Case Histories as those listed for RCA 16K receiver

RCA Radiola 17

Inoperative (no plate voltage at sockets, power pack O.K.)	1)	"shorted" a-f by-pass condenser
	2)	if there is no plate voltage at detector, check for a "shorted" plate-cathode by-pass condenser
	3)	open a-f transformer winding
	4)	"open" voltage divider resistor

(Cont'd over)

RCA Radiola 17—(*Cont'd*)

Inoperative due to repeated breaking of condenser drive cable	1)	due to scraping of cable on edge of drum. Install new cable, rotate knob fully in one direction and then the other —several times. If scraping is noticed, remove dial scale from drum, and file edges to assure better clearance. When replacing scale, put it slightly off center, move toward the edge of the drum on which no filing has been done
Weak reception	1)	"open" grid-suppressor resistor. (This will be apparent by lack of grid voltage on the particular r-f tube in whose grid circuit the faulty suppressor is connected)
	2)	connect a 2-mfd. 600-volt condenser from the '80 filament to the input of the first filter choke. The filter chokes may be found in the minus B lead
	3)	change to power detection by removing the grid leak and condenser. Connect the det. plate return in parallel with the plate supplies of the r-f tubes (or the power tube if necessary, to get sufficient voltage), break the det. cathode circuit and insert a 50,000-ohm variable resistor, by-passed by a 0.5-mfd. condenser. Adjust the variable resistor for best reception
	4)	if there is no detector voltage, check for an "open" detector grid resistor
Weak reception (dial calibration shifted)	1)	gang condenser bearings "worn." Move stators so that rotor and stator plates are evenly spaced
Distortion	1)	potentiometers not properly adjusted. This results in sufficient hum to cause distortion. Readjust them
Whistling or squealing	1)	screw loose on terminal board making poor contact. Tighten all screws
	2)	increase size of the grid-suppressor resistors just sufficiently to end oscillation
	3)	"open" '26 filament by-pass cond.
	4)	change 1000-ohm grid resistor in second r-f stage to 2000-ohms
	5)	shunt 600 ohms across primary of second or third r-f transformer
Hum	1)	clean contacts on all hum-control potentiometers and adjust for minimum hum
	2)	check '26 filament by-pass cond.
	3)	"shorted" filter choke
	4)	poor contacts between tube prongs and socket springs. Clean and adjust
	5)	mechanical hum may be due to loose power transformer laminations
Modulated hum	1)	incorrect bias on any of the tubes will cause this trouble. Check for the causes which follow
	2)	"shorted" by-pass condenser in the power unit
	3)	check the grid circuits and grid returns of the r-f tubes. An "open" grid suppressor will cause hum
	4)	"open" volume control (which is in grid-return of the first r-f tube. A continuity check between aerial and ground posts will show this up. Poor contact at the moving arm will also cause this trouble
	5)	"shorted hum control potentiometer
Hum on phonograph	1)	install a 6,000-ohm resistor across the secondary of phono-input transformer
Howling	1)	microphonic tubes. Try a new detector
	2)	put line control switch in the position that gives the least light at the pilot lamp
	3)	"open" audio by-pass condensers—especially the one connected across secondary of first a-f transf.
	4)	faulty grid leak—or open grid connection in any of the tubes
	5)	"open" grid-suppressor resistor in r-f stage
	6)	connect a 250,000-ohm resistor across first a-f transf. secondary stage
Crackling or frying noises, Fading	1)	clean volume control contacts and resistor strip
	2)	clean tube socket prongs
	3)	tighten all connections on terminal board
	4)	faulty grid suppressors. Replace (first one has value of 600 or 1,000 ohms; that in the third r-f stage is rated at 1,000 ohms)
	5)	faulty choke coil inside one of the tuning coils
	6)	check for "noisy" phone condenser or audio transformer
Improving tone quality	1)	install a 2,000-ohm resistor shunted by a 1-mfd. condenser from the detector cathode to ground. Remove the detector plate feeder from 45-volt tap and place it on the 100-volt tap of the voltage divider. Replace the '26 first a-f tube with a '27 type by changing socket to UY type and using the filament winding of the detector for the first audio tube also. It may be biased with a 2,000-ohm resistor by-passed by 1-mfd. cond.

RCA-Victor RE-17

Poor tone	1)	replace the 0.004-mfd. condenser across the primary of the output or speaker transformer with a 0.01-mfd. condenser (tubular type)

RCA R-17M

Inoperative	1)	"open" or "shorted" dry electrolytic condenser located on top of chassis, in front of variable condenser gang
	2)	"open" detector-plate resistor
Inoperative, Intermittent reception	1)	antenna lead "shorted," or "shorting" to eyelet of bracket
Weak reception	1)	weak permanent magnet in "inductor" type speaker. Replace speaker with good quality permanent-magnet dynamic speaker and suitable output transformer
Weak, distorted reproduction	1)	armature of "inductor" type magnetic speaker not centered. Re-center
Weak reception, Whistling or squealing	1)	check tubular dry electrolytic condenser (located in bottom of set) for "open" section or decreased capacity. Consists of a 2-mfd. section for plate by-passing and a 4-mfd. unit for screen by-passing
Whistling or squealing	1)	antenna lead "bunched" too close to receiver. Give this lead ample room
Hum	1)	"open" or "shorted" dry electrolytic condenser located on top of chassis, in front of variable condenser gang
Distortion on "locals"	1)	too much volume turned on—thus overloading detector. Advise customer to keep volume-control turned down lower

RCA Radiola 18 (AC)

Inoperative (voltages O.K.)	1)	"shorted" output condenser. Test by inserting phones in '71 plate lead

(Cont'd)

RCA Radiola 18 (AC)—*(Cont'd)*

Inoperative (voltages low or absent)	1)	"shorted" condenser in block in power pack
	2)	"open" plate resistor in power pack. Replace with one of higher wattage rating
Inoperative (no plate voltage on '71A)	1)	"open" voltage divider resistor in power unit
Inoperative due to repeated breaking of condenser drive cable	1)	see Case History for this same trouble listed for Radiola 17 receiver
Low volume	1)	this may be improved by disconnecting the antenna lead from one side of the volume control potentiometer and connecting that lead to the movable arm, disconnecting the lead to the grid of the first r-f tube from that point. Now, between the grid of the first r-f tube and the side of the potentiometer to which the antenna was formerly connected, connect an r-f choke. This will increase receiver output considerably
	2)	connect a 2-mfd. 600-volt condenser from filament of '80 tube to the chassis. If oscillation occurs, which cannot be balanced out, install grid suppressors
Weak reception (no grid voltage on one r-f tube)	1)	"open" grid-suppressor resistor in that stage
Weak reception (dial calibration shifted)	1)	gang condenser bearings "worn." Move stators so that rotor and stator plates are evenly spaced
Weak reception, Poor selectivity	1)	adjust r-f compensating condenser
Distortion	1)	if det. plate voltage is high, check for "open" detector plate-limiting resistor
	2)	pilot light "shorting" to the dial—thus shorting the bias. See that pilot light does not touch the dial at any point in its range
Whistling when new tubes are installed	1)	locate the r-f compensator (located below and between the second and third tuning condensers and accessible through the hole in the condenser frame) and turn it counter-clockwise until oscillation ceases. The correct adjustment is made as follows: Tune in some station between 1,400 and 1,500 kc and turn the adjusting screw clockwise, until you obtain oscillation. Then turn it counter-clockwise until the oscillation stops. Selectivity may be improved to some extent by adjusting the r-f compensating condenser screw slightly clockwise to bring circuit closer to oscillation point
Whistling or squealing over entire dial	1)	"open" by-pass condenser across split primary of second and third r-f stages
Whistling or squealing at high-freq.	1)	adjust r-f compensating condenser as explained in detail above
Loud whistling or squealing	1)	if all attempted cures fail, check the tuned primaries of the second and third r-f stages. The fixed tuning condensers sometimes become defective
Noisy, intermittent reception	1)	poor contact, or snapped tabs of by-pass condensers across primary winding

(Cont'd)

RCA Radiola 18 (AC)—*(Cont'd)*

Noisy reception, Fading	1)	clean contacts and resistance strip on volume control—or, replace control
	2)	clean tube socket prongs
Noisy reception, Intermittent, "crackling" (volume control at minimum setting; ant. and gnd. connected) Noise stops when second r-f tube is removed	1)	intermittently open-circuiting coil in series with the primary winding of the third r-f transformer. Replace this coil with a small choke coil of similar design
Crackling noises at all volume control settings	1)	partial open-circuit in one of the r-f coil primary link circuits
	2)	"noisy" phone condenser or a-f transformer
Hum modulation	1)	"open" volume control which is in the grid-return of the first r-f tube. A continuity check between the aerial and ground will show this difficulty. A poor contact between the slides of the control and the resistance element should also be suspected
	2)	corroded contacts on hum-adjusting potentiometers
Howl	1)	microphonic tubes
	2)	"open" by-pass condenser connected across secondary of first a-f transformer. If a replacement cannot be obtained, remove the "open" condenser and try a 0.00025-mfd. fixed condenser from grid of 1st a-f tube to the chassis
	3)	connect 250,000-ohms across 1st a-f transf. sec.
Improving tone quality	1)	proceed in same manner as outlined for Radiola 17 receiver

RCA Radiola 18 (DC)

Inoperative (no plate voltage)	1)	"open" 1,000-ohm plate resistor located in power unit. Connect a 1,000-ohm 20-watt replacement from binding post No. 7 to binding post No. 9 for permanent repair

RCA RE-18

See also Case Histories listed for RCA R-11 receiver

Motorboating sound	1)	leaky by-pass or filter condensers, contained in a common can. It is usually advisable to replace the entire can
	2)	connect a 0.1-mfd. condenser across the resistor mounted inside the antenna coil
No AVC action	1)	decrease in value of one of the AVC resistors

RCA R-18W

Weak reception	1)	weak permanent magnet in "inductor" type speaker. Replace speaker with good quality permanent-magnet dynamic speaker having proper output transformer

RCA 18T

See also Case Histories listed for RCA 16K receiver

Inoperative on push-buttons	1)	if dial tuning is O.K., replace 33,000-ohm oscillator grid leak with a 50,000 or 55,000-ohm resistor

RCA 19K

See also Case Histories listed for RCA 16K receiver

"Waver" or "wow" in phono reproduction	1)	see remedy for this Trouble Symptom listed under RCA O-2

RCA RE-20

See also Case Histories listed for RCA R-50 receiver

Inoperative unless AVC tube is withdrawn (high control-grid bias on r-f and i-f tubes)	1)	"faulty" 1-meg. resistor in AVC grid-return circuit—the one in the power unit, on the resistor strip
Weak reception (volume increases if AVC tube is removed)	1)	replace 0.1-mfd. condenser connected at junction of two 0.1-megohm resistors in AVC grid-return circuit. Other end of condenser is grounded
Weak reception (adjusting trimmers does not improve performance)	1)	check tuning condenser connections. Rotor contacts may be "open"
Weak reception accompanied by whistling or squealing	1)	replace 0.1-mfd. screen by-pass condenser
Intermittent operation (on either "radio" or "phono" position)	1)	corrected contact segments of "master" switch (remove switch cover by straightening the two tabs on frame). Clean contacts carefully with fine sandpaper, being careful not to bend copper contact arms out of proper shape
Whistling or squealing over entire dial	1)	"open" 0.002-mfd. 400-volt condenser from 2nd detector plate to cathode
Hum	1)	open 0.1-mfd. condenser from '27 2nd detector cathode to one side of 1-meg. ¼-watt resistor. (Condenser is in power pack and has two *blue* leads)
Tone control noisy (volume decreases on "bass" position)	1)	replace small choke (in metal can located below chassis). May be replaced with a midget filter choke
Improving tone quality	1)	connect the screen grids of the pentode tubes to the plates (instead of to B-plus) and remove the 18,000-ohm carbon resistor and the 0.005-mfd. condenser connected in series across the plates of these tubes

RCA U-20

Push-buttons inoperative at times	1)	inspect for slightly torn adjustment belt —caused by protruding rivet
Phono turntable "wobbles"	1)	see remedy for this Trouble Symptom listed under RCA U-9 receiver
Circuit improvement	1)	if *R16* is a 8,200-ohm unit change it to a 3,900-ohm unit (Stock *No. 12955*)

RCA VA-20 Wireless Record Player

Distortion at advanced volume control settings	1)	remove self-bias resistor *R-2* and associated by-pass condenser *C-4* from cathode circuit of 6A8 modulator-oscillator stage. Install:

(Cont'd)

RCA VA-20 Wireless Record Player—*(Cont'd)*

Distortion at advanced volume control settings —*(Cont'd)*		(a) a connection between 6A8 cathode (K) and shell (SH) (or chassis) (b) a 10-megohm resistor (Stock *No. 13601*) between "modulator grid" and cathode (K) on 6A8 socket (or chassis) (c) a 0.0025-mfd. condenser (Stock *No. 5107*) in series with *green* lead from arm of volume control to "modulator grid" (d) a 120,000-ohm resistor (Stock *No. 13734*) across the volume control from terminal 1 to terminal 3. The overmodulation condition can also be avoided by operating the VA-20 volume control at a retarded position, and regulating volume by means of the receiver control. The above changes, however, effect a foolproof cure, and should be incorporated on any instruments being serviced
Changing frequency range	1)	if it is desirable to employ a different range of frequency on this wireless record player, it may be accomplished readily by removing turns from the oscillator coil. The resultant frequency ranges for given numbers of removed turns are:

Turns Removed	Frequency Range
8	580 kc — 710 kc
16	630 kc — 770 kc
24	700 kc — 850 kc
32	760 kc — 940 kc
40	850 kc — 1,050 kc
48	960 kc — 1,200 kc
56	1,100 kc — 1,400 kc
64	1,300 kc — 1,650 kc

RCA Radiola 21

Inoperative	1)	inspect plate prongs of '22 tube sockets, making sure that they do not make contact with the chassis when the tubes are inserted
Whistling or squealing and noise when tuning	1)	clean tuning condenser wipers, and tuning condenser shields where they fit into chassis base
Motorboating sound	1)	check 1-mfd. condenser (*C14*) which bypasses the screens of the r-f, first detector and i-f stages
Howl	1) 2)	microphonic tubes "open" by-pass condenser across secondary of first a-f transformer. If a replacement is not obtainable, remove this condenser and connect a 0.00025-mfd. condenser from the first a-f tube grid to chassis
Hum	1)	if hum disappears when the speaker cone is held, re-center or replace the cone

RCA R-21

See also Case Histories listed for RCA R-11

Noisy volume control	1)	remove back of volume control by lifting the three small lugs holding it to casing. Remove grease and grime from spring in center of unit by cleaning with very smooth sandpaper. Re-assemble and connect the volume control to receiver circuit
Slipping dial cable	1)	place a piece of friction tape on the dial cable pulley. Rotate the dial several times till the tape locates itself on the pulley, thereby stopping it from slipping

(Cont'd)

RCA R-21—(*Cont'd*)

Slipping dial cable —(*Cont'd*)	2)	give the cable an additional turn around the gang shaft, releasing the spring between the dial so that the turn may be made with a loose cable. The spring should then be fastened into position and the dial automatically restores itself in its place
Distortion at low volume, Unstable operation	1)	open-circuited 500,000-ohm resistor in the secondary return circuit of the first r-f stage
	2)	insert suitable resistors to reduce the heater voltage of the AVC tube to 1.5-volts
	3)	interchange the three type '27 tubes in the chassis until the best operating condition is obtained
Distortion at high volume	1)	detune either one or a combination of the trimmer condensers located underneath the chassis
	2)	insufficient AVC action, due to leaks in the AVC grid circuit or to gassy type '35 tubes. Replace with new tubes
Distortion (removal of one of the type '47 push-pull tubes restores set to normal)	1)	internal short-circuit between primary and secondary in push-pull input transformer
Fading, Distortion	1)	change in value of the two 1-megohm and one 2-megohm AVC resistors located on the fibre resistor panel . Replace with new units
Fading (about 15 minutes after being switched on) (occurs only at the high-frequency end of the broadcast band, or at the part of the band where the weak stations are located)	1)	defective volume control; fading occurring only at maximum settings, which are necessary when small stations are tuned in. Replace with new unit
Low-frequency oscillation at station settings on the tuning dial	1)	poor AVC action, caused by low filament voltage on AVC tube, due to defective AVC winding on power transformer. Rewind or replace power transformer; or replace the type '27 AVC tube with a type '56 tube
Clicking noise on d-c conversions	1)	improper filtering of d-c current
Hum, Motorboating sound (when 47 tube behind '80 rectifier is removed)	1)	caused by 1-meg. resistor connected between terminal *No. 3* no rear phono terminal strip (phono connections) and terminal *No. 6* on resistor board. The end of the resistor (connected to terminal *No. 3*) usually "shorts" to terminal *No. 4*. To test, "short" terminals *3* and *4* with screw-driver. If this does not increase the trouble, the cause is at this point. Insulate this lead

RCA VA-21 Wireless Record Player

Motor hum and excessive vibration	1)	insufficient lubrication, or anything that that will cause "binding"
	2)	leather washer not oiled. (Check to make certain that the leather washer is *above* the steel washer)

(Cont'd)

RCA VA-21 Wireless Record Player—(*Cont'd*)

Motor hum and excessive vibration —(*Cont'd*)	3)	motor not properly supported from motor board
	4)	burrs on poles of rotor or stator. Remove with fine emery cloth

RCA D22-1

Intermittent reception, Distortion, Poor AVC action, Erratic Magic eye deflection	1)	unstable alignment of 3rd i-f transformer (caused by heat from bleeder resistor *R-44, R-45* (which in many chassis is mounted on the rear apron of chassis directly beneath the transformer). Change its location
No expansion, Drop in volume when expander is turned on	1)	replace part *No. 11608* consisting of two 1-mfd. and one 4-mfd. condensers (*C-208, C-209, C-210*)
	2)	check 100,000-ohm resistor *R-203* in 6L7 plate circuit, for decreased resistance
	3)	check condensers *C-201, C-202, C-206*
Hum (when switch is in "phone" position)	1)	replace 18-mfd. condenser *C-106* (Part *No. 11496*) in first-audio 6C5 plate circuit
Improving treble response for more brilliant reproduction of records	1)	remove *blue* and *yellow* wires on input pack (terminal Nos. 4 and 9). This will also provide smoother volume control action

RCA OSC-22 Wireless Oscillator

Circuit changes for improved performance	1)	connect low end of volume control and resistor *R-5* and condenser *C-11* to the common negative line instead of to chassis
	2)	change condenser *C-11* from 0.2-mfd. to 0.1-mfd. (Stock *No. 4839*)

RCA Radiola 22

Same Case Histories as those listed for RCA Radiola 21

RCA R-22, R-22S

Inoperative (*B*-voltage low)	1)	8-mfd. tubular voltage-doubling condenser "open" (mounted under chassis)
Receiver overheats, Impregnating waxes melt and run out, Receiver will not stay aligned, Electrolytic condensers go bad	1)	heat produced by the large 180-ohm wire-wound voltage-dropping resistor mounted inside the receiver overheats the entire chassis. Use a "Cordohm" type resistor in its place, so the heat will be developed *outside* of the receiver

RCA RO-23

Inoperative	1)	check waveband switch (especially for corroded contacts or loose wires.) Resolder all suspicious joints
	2)	if receiver smokes, check pilot light socket for loose terminals causing leads to "short"
Weak reception	1)	replace 8,000-ohm resistor connected between screen and cathode of r-f and i-f tubes

RCA 24BT1, 24BT2

Dial pointer loosens	1)	due to expansion and contraction caused by temp. changes. Fasten pointer to molded button shaft with "Du Pont Household Cement"

RCA Q24

Inoperative on short-wave bands	1)	connect a 10-ohm ¼-watt resistor in series with oscillator grid (mount it directly at the tube socket) in order to suppress parasitic frequency oscillations causing this trouble

RCA 25

Removing catacomb assembly	1)	mark the leads from the terminal strip for identification, and remove them. Remove all tubes, unbolt the catacomb unit and dismount it. Place the entire unit in a pan on a hot plate or in an oven where it may be gradually heated. When the sealing material becomes fluid it may be drained off. Destroy the seals and remove the top plate and the unit is ready for repairs and inspection and testing. The grid condenser and also the windings of the various transformers in this unit often become faulty

RCA 25BK

Distortion on strong local station	1)	overloading of first stages of receiver. Use a shorter antenna, or connect a 50-mmfd. condenser in series with antenna
Reducing minimum volume on strong-station reception	1)	re-position the 1H5GT 1st-audio 0.0018-mfd. condenser *C-5* and 10-megohm grid resistor *R-7* so they are close to the front and end aprons (close to the volume control). Keep both away from the 3Q5GT tube plate. Install a shielded lead to grid cap of the 1H5GT tube

RCA 25BT3

See also Case Histories listed for RCA 25BK receiver

Hum modulation when CV-42 "Electrifier" power unit is used	1)	connect a 220-mfd. molded mica condenser in series with the *blue* antenna lead. Disconnect the *black* ground lead and condenser *C-19* from the bottom lug on the antenna coil. Connect a jumper from this lug to chassis. Connect the *black* ground lead to condenser *C-19* and tape the joint. It is not necessary to remove chassis from cabinet to make these changes

RCA RAE-26

See also Case Histories listed for RCA R-11 receiver

Weak reception	1)	"carbonized" 14,300-ohm screen-drop resistor. Replace with wire-wound unit
	2)	"carbonized" 18,000-ohm screen-bleeder resistor. Replace
AVC action weak, Noisy	1)	check AVC plate choke
	2)	check condensers *C-18, C-20, C-21* for "shorts"
Low phono volume	1)	portion of the primary of phono input transformer short-circuited, usually caused by the shielded conductor connecting to terminals *No. 2* resting against terminal *No. 3* which is not used. Tape up the shielded lead and remove it to a point where it will not touch terminal *No. 3*
Hum (intermittent)	1)	caused by 1-meg. resistor connected between terminal *No. 3* on rear phono terminal strip (phono connections) and terminal *No. 6* on resistor board. The end of this resistor (connected to terminal *No. 3*) usually "shorts" to terminal *No. 4*. To test, "short" terminals *3* and *4* with a screw-driver. If this does not increase the trouble, the cause is at this point. Insulate this lead

RCA R-27

Inoperative	1)	"open" or "shorted" dry electrolytic condenser located on top of chassis in front of variable condenser gang. Replace
Loss of volume (sounds like an open-circuiting grid)	1)	magnetic speaker armature off center
Low volume	1)	decrease in capacity of double 5-mfd. condenser which by-passes the cathode bias resistors in the detector and output stages. Replace with a new unit
	2)	weak permanent magnet in "inductor" type speaker. Replace with permanent magnet "dynamic" speaker having proper output transformer
Distortion on "locals"	1)	volume control too far advanced. Turn counter-clockwise till tone improves, then set this point as *maximum*
Whistling or squealing	1)	antenna wire coiled or bunched too near receiver
	2)	volume control setting too high. Reduce setting
	3)	check dry electrolytic condenser located in bottom of set. Consists of 2-mfd. section for plate by-passing, and a 4-mfd. unit for screen by-passing
	4)	antenna lead "bunched" too close to receiver
Speaker rattle immediately after set is turned on	1)	glue two pieces of cork in cabinet at top and bottom where speaker cone comes, making sure that they are just thick enough to come in contact with the cone, forcing it back slightly
Hum	1)	"open" or "shorted" dry electrolytic condenser located on top of chassis in front of variable condenser gang. Replace

RCA R-28, R-28BW, R-28BWC

Inoperative (but appreciable background noise)	1)	check condenser *C-24* (across oscillator plate supply)
	2)	"shorted" filter condenser section
Intermittent reception, Noisy	1)	replace 2A7 det.-osc. tube—even if it checks O.K.
Weak, distorted reception	1)	"shorted" 0.25-mfd. condenser *C-17*
Weak reception, Poor selectivity	1)	reception may be improved by using an outside antenna instead of the loop with which the receiver is provided. An antenna coupler must be used, and may easily be made. Select a form 2½ inches in diameter and about 4 inches long. Wind on about 25 turns of 26 DCC wire and make a tap connection. Then wind on 25 more turns. This is the secondary. The windings of this coil should be spaced about ½-inch apart. The primary will consist of about 25 turns of the same kind of wire closely wound. Two binding posts may be placed at the edge of the tube for antenna and ground. The coupler is mounted in the cabinet. The two outside turns of the secondary go to the outside loop socket terminal, while the center tap connects to the center terminal of the loop socket
Weak reception, and oscillation (impossible to align receiver circuits)	1)	"ground" the case of the oscillator padding condenser

(Cont'd)

RCA R-28, R-28BW, R-28BWC—*(Cont'd)*

Whistling or squealing	1)	"open" or "dried-up" filter condenser
	2)	replace 2-mfd. screen and plate by-pass condensers which are in a box under the chassis (directly under the power transformer)
Excessive filament voltage	1)	changed resistance in one or more sections of filament voltage divider strip
	2)	"open" in one or more sections of the above strip
Noise (sounding like loose connection)	1)	see if one of flexible leads of '57 plate choke is rubbing against *green* 500-ohm 2A5 cathode resistor between the r-f choke and rear of chassis
Loud "putting" noise (tubes and voltages check O.K.)	1)	oscillation of mixer section of type '2A7 tube. Insert an r-f choke in series with the screen-voltage feeding wire of the mixer section, by-passing from the screen to ground with a 0.5-mfd condenser
Speaker rattle	1)	top part of cone vibrating against frame on loud signals, since cone is tightened only at bottom. Secure top edge of cone to frame with small 4-36 nuts and bolts
"Gurgling" and "squawking"	1)	"open" filter block

RCA 28X

Hum when station is tuned in	1)	if there is no 0.05-mfd. 400-volt condenser from 25Z6GT rectifier plate to B—, add one.
Improvement	1)	change oscill. grid condenser from a 33 to a 47 mmfd. unit

RCA 28X5

See also Case Histories listed for RCA 28X receiver

Push buttons have insufficient range	1)	realign i-f amplifier at exactly 455 kc
	2)	replace main oscillator coil, and realign receiver

RCA R-28P, R-28P (A to G)

Inoperative (but appreciable background noise)	1)	check condenser *C-24* across oscillator plate supply
Inoperative on short-wave	1)	short-circuited trimmer condensers on band switch
Intermittent reception, Fading	1)	open-circuited detector secondary return by-pass condenser
	2)	open-circuited r-f cathode by-pass condenser
Weak reception (distorted)	1)	"shorted" 0.25-mfd. condenser *C-17*
Whistling or squealing (all over dial)	1)	"open" 4-mfd. electrolytic screen by-pass condenser (mounted under chassis in a common container with another 4-mfd. unit). Replace both
Whistling or squealing, Motorboating	1)	loss in capacity of second section of dual filter condenser
Noisy	1)	faulty r-f coil mounted in shield on top of chassis
Noise sounding like loose connection	1)	see if one of flexible leads of 57 plate choke is rubbing against *green* 500-ohm 2A5 cathode resistor between r-f choke and rear of chassis

(Cont'd)

RCA R-28P, R-28P (A to G)—*(Cont'd)*

Gurgling and squawking	1)	check for "open" filter block
Short-wave switch does not fall into place when knob is turned	1)	due to falling out of clip which fits into slot on shaft, holding the shaft in place. Leave out the clip and, instead, cut a slot in the end of the shaft so that an ordinary floor nail can be fitted into the slot. Solder the nail to the shaft. Now when the switch is turned, the nail will fall against either one side or the other side of the protruding bakelite wall, holding the switch in place in either position

RCA CE-29 (Automatic Electrola)

Mechanical cycle of phono repeats indefinite—or intermittently	1)	locate the round plate with a notch in it (under the turntable and motor board). Into this notch fits a narrow arm which, when engaging, stops the cycle of the mechanism and allows the record to play through. If the arm is bent even slightly out of position, the mechanical cycle will repeat indefinitely. Bend the arm carefully so it is on *exactly* the same plane as the plate

RCA M-30 Auto Radio

Inoperative (fuses blow as soon as receiver is hooked up)	1)	"shorted" 0.03-mfd. condensers in the vibrator space unit
Inoperative, Intermittent reception, Weak reception	1)	loss of tension in contact springs (or dirty contact springs) in d.p.s.t. "off-on" lock switch. Tin the springs and back them up with solder to increase their strength — or replace switch
	2)	broken stranded antenna lead-in wire inside the shield—usually where it is brought out through the hole in the end of the set and clamped to the outside. Replace with new wire
Weak reception	1)	a quick check to see if this is due to weak C batteries is to remove the AVC tube from its socket. If dead C batteries are the cause, the volume will now jump to its normal value
Receiver plays without any control on the volume	1)	replace broken *green* wire in the cable that runs from receiver to control unit. When it breaks, it disconnects the cathode of the AVC tube
Faulty control of volume	1)	most frequently caused by change in resistance of carbon unit located in remote control box. The correct value is 70,000 ohms. Check the volume control resistance before installing the carbon unit, as its value may have changed, necessitating some compensating difference in the fixed unit. The control should check at 50,000 ohms. A slide resistor may be used to determine the correct total resistance
	2)	try new '37 tubes in both AVC and 2nd detector circuits. Check batteries and replace any below normal

RCA U-30

Automatic tuning inoperative or erratic	1)	"leaky" or "open" 60-mfd. 40-volt A-C electrolytic tuning motor starting condenser (mounted directly on tuning motor)

RCA P-31 (Portable Receiver)

Weak signals, No volume control action	1)	"open" i-f coil winding. Re-solder all soldered connections on the i-f transformers to eliminate any possible "rosin" joints

RCA-Victor R-32

Inoperative	1)	"shorted" by-pass condenser
	2)	"shorted" filter condenser
	3)	"open" speaker field. Remove cover and look for burned or broken wire
Inoperative (no det. plate voltage)	1)	corroded or "open" contacts in radio-phono transfer switch
Intermittent reception	1)	if tubes and voltages check O. K., remove speaker and examine for torn cone around fibre washer at center
Intermittent, noisy reception	1)	loose resistor strip in volume control
	2)	corroded volume control resistance strip and contact arms
	3)	open-circuiting pigtail connection to dynamic speaker voice coil
	4)	loose contacts of radio-phono transfer switch
	5)	speaker cone torn around fibre washer at center
Weak reception (all plate voltages check O.K.)	1)	check for loose connection on power plug into pack from chassis. Spring contacts on female section frequently corrode sufficiently to reduce heater supply values
Weak reception with background noise	1)	replace '27 detector tube with a 56
Fading	1)	worn bearings in variable condensers. In many cases these bearings may be tightened with an auxiliary spring tension device
Hum	1)	replace 20-ohm resistor across heater of '27 tube. Original resistor changes in value
	2)	"shorted" 0.1-mfd. filter choke by-pass
	3)	clean and adjust hum control
	4)	change '26 first audio tube to a '27. Disconnect the filament leads of the '26 tube socket and connect them to the filaments of the '45 power tubes. Reconnect the grid and plate leads to the respective terminals and by-pass the cathode of the '27 with a 25,000-ohm resistor and a 1-mfd. condenser
Whistle in background of all stations	1)	"open" 500,000-ohm resistor across half the secondary winding of the interstage push-pull audio transformer
Noisy volume control	1)	replace with a 10,000-ohm unit. Disconnect the *brown* resistor that biases the '26 r-f tubes. Connect it to one side of new control. Connect antenna to other side, ground center arm. This change will increase selectivity and give the control longer life
Distortion, Instability	1)	loose detector grid leak
	2)	defective speaker cone. Replace
Pilot light bulb burned out	1)	bulb is 110-volt type. Re-wire for 2.5-volt unit as these are more easily obtainable for replacement. Connect to '45 tube filament supply line

RCA Q-33

Choking	1)	"open" 10-meg. 6SQ7 grid resistor

RCA Radiola 33

See also Case Histories listed for RCA Radiola 18 receiver

Inoperative	1)	replace plate resistor with one of higher wattage rating

(Cont'd)

RCA Radiola 33—*(Cont'd)*

Inoperative (no plate voltage on '71A)	1)	"open" voltage divider resistor in power unit
Weak reception with oscillation	1)	readjust detector trimmer condenser
Weak reception (no grid voltage on one r-f tube)	1)	"open" grid resistor
Weak reception (dial calibration shifted)	1)	gang condenser bearings worn. Move gang condenser stators so that rotor and stator plates are evenly spaced
Noisy on all stations	1)	if check shows that trouble is not due to outside noises, check for noisy phone condenser or audio transformer
	2)	clean tube socket prongs and volume control contacts
Audio howl	1)	connect 250,000-ohm resistor across first a-f transf. secondary
Hum	1)	corroded resistance windings on hum adjusting potentiometers in power unit
	2)	pilot light socket "shorting" to chassis

RCA M-34 Auto Radio

Inoperative Vibrator noise (operative when removed from the car)	1)	poor connection between plug and socket which connects the aerial to the receiver. Clean the connector contacts and tighten the connection
Weak reception Poor AVC action, Poor tone, Poor noise-suppression action	1)	make ALL of the following changes. Do not make only *a few* of them as the result may actually be detrimental to the operation of the receiver
	a)	replace the 270-ohm first-detector 6A7 cathode resistor (*R3*) with an 80-ohm, ½-watt unit
	b)	replace the 400,000-ohm resistor in series with the arm of the volume control (*R9*) with a 0.3-megohm, ½-watt unit
	c)	see that the 0.000375-mfd. condenser, which by-passes the "hot" heater prong to chassis in the power converter is connected from the "hot" heater prong of the type '78 first r-f tube
	d)	replace the type '89 output pentode tube with a type '41 tube, replacing also the 1,000-ohm cathode resistor (*R11*) with a 500-ohm, 2-watt unit
	e)	replace the input transformer (T2) (Part *No. 6488*) with a higher ratio unit (such as Part *No. 6732*)
	f)	replace the 60,000-ohm resistor across the a-f transformer (*R10*) with a 250,000-ohm unit
	g)	relieve back pressure at the bottom of the trimmer case by removing the trimmer adjustment plate, or drill about eight ½-inch holes at the top of the center of the case
	h)	replace the 500,000-ohm resistor in the type '6B7 control-grid circuit return lead with a 0.3-megohm, ½-watt unit
	2)	"open" or shorted" antenna condenser (this condenser consists of the distributed capacity of two turns of wire around the secondary coil)
	3)	broken wire in 3-wire volume control cable. Install an extra new shielded lead from control terminal to receiver chassis
	4)	"open" i-f coil winding
	5)	try connecting a 12-mfd. 150-volt electlytic condenser between voice coil of speaker and ground

(Cont'd)

RCA M-34 Auto Radio—*(Cont'd)*

Weak reception at "low" frequencies	1)	check low-freq. padding condenser in series with oscill. tuning condenser. This condenser should be adjusted at around 600 kc
	2)	replace antenna coil if trimmers seem O.K.
Weak reception at "high" frequencies	1)	if trimmers are O.K. check 0.5-mfd. cond. across cathodes of 78 and 6A7 tubes
Intermittent, muffled reception	1)	see if particles worn from vibrator points have fused into bakelite insulating strip against which points rest. If so, clean strip thoroughly with a file
Intermittent reception	1)	if accompanied by vibrator "hash" check for faulty vibrator. Replace
Intermittent reception	1)	if accompanied by oscillation, replace the 3.6-mfd. screen grid by-pass
Intermittent reception after short time	1)	resolder connections on oscillator coil farthest from antenna lead
Receiver starts playing late (or only after motor is raced)	1)	replace 6A7 tube
Fuses blow immediately upon being installed	1)	"shorted" 0.03-mfd. condensers in vibrator base
Loud roar after set warms up	1)	check for arcing at vibrator points. If they arc, connect a 500,000-ohm resistor across the transformer secondary, the terminals of which are brought out to two insulated screws. Connect two 0.01-mfd. 600-volt condensers across the secondary, in series, grounding the midpoint between them
Noisy reception after new vibrator is installed	1)	twist the primary and secondary leads of the vibrator
Noisy after standard suppression has been installed	1)	"ground" the rubber-mounted triangular plate of tuning-control sheath to side of chassis
Vibrator "hash," noisy	1)	check for faulty 78 tube, or cathode-to-heater "shorts" on any other tubes (particularly the r-f tubes)
	2)	see that screws holding vibrator in place are tight
	3)	see that shielding of cable to control-head is O.K. and securely soldered to the base of the vibrator. Bond the tuning shaft cable and volume control cable to chassis. Bond the antenna lead shielding direct to chassis
	4)	broken soldered bond between chassis and the partition separating the power transformer from rest of set. Resolder the bond
"Metallic" vibration at certain musical freq.	1)	tighten light sheet-iron strip covering trimmer condenser adjusting holes, or install light cork gasket between plate and case
Distortion at full volume	1)	if all bias resistors and condensers check O.K., look for volume control connection touching metal control box
Distortion, (low speaker output)	1)	try removing trimmer-adjustment opening plate on bottom of case to relieve back-pressure on speaker cone. If necessary, drill 6 or 8 half-inch holes in center of top of case to relieve pressure

(Cont'd)

RCA M-34 Auto Radio—*(Cont'd)*

Volume control inoperative (stations heard at low volume)	1)	"open" i-f coil winding. Go over all i-f coil soldered joints with soldering iron
	2)	check for "open" wire in main control cable. Install an extra new shielded lead from the control terminal to receiver chassis
	3)	"shorted" or "leaky" 6B7 tube. Also check volume control
Speaker rattle,	1)	try re-centering cone
	2)	remove speaker from case, and look for filings at pole pieces. (If there is no hole in screen for centering punch one ⅜ inch hole in it before installing.) Drawing speaker up with nuts on face of chassis may twist frame and throw cone off center. If voice coil glue loosens don't try repair. Replace it
"Howling" on strong stations	1)	try replacing 6A7 tube. If howl still persists, replace *yellow* 400,000-ohm resistor on resistor board with a 500,000-ohm unit, and connect a 0.0001-mfd. condenser across this resistor if set lacks "pep"
Inoperative (pronounced buzz from vibrator)	1)	see if oscillator tube filament prong is "shorting" to diode prong of 6B7 tube
	2)	check condensers shunting vibrator contacts
	3)	check for faulty condenser between B-plus speaker lead (second from right, looking into back of set) and chassis or ground
Vibration of set loosens mounting	1)	remount the receiver on ½-inch rubber, cork or felt. Place this behind set on the bolt and compress tightly with the nut. This will provide a permanent friction lock for the mounting bolt

RCA-Victor R-35

Inoperative, or weak reception	1)	turn on set and let tubes warm up. Set dial for a strong local station. Remove detector tube and then replace it quickly. If set plays for a few seconds, and then fades out, replace detector screen resistor
	2)	"open" r-f screen chokes
	3)	"open" r-f cathode chokes
Inoperative (no plate voltage on '27 tube)	1)	check plate coupling condenser between plate of this tube and primary of input push-pull transformer. If faulty, replace with a 0.2-mfd. unit
	2)	"open" 70,000-ohm 1st audio plate resistor (*red* and *green*). Lack of continuity between plate socket terminal of the tube to plate socket terminals of any of the r-f tubes indicates trouble
Inoperative, Weak, Fading, (no detector screen voltage)	1)	"open" white 1.5-megohm screen resistor (with *red* end)
Low volume, Distortion, Whistling or squealing	1)	open-circuited 1.5-megohm detector tube screen-grid resistor. Replace with a 1-megohm, 2-watt unit. This resistor is located underneath the resistor board inside the chassis and connects to the second and third lugs counting from back to front on the right hand row, looking under the chassis with controls toward you

(Cont'd over)

RCA-Victor R-35—(Cont'd)

Noisy reception	1)	if jarring the set results in noise, check the second r-f coil and condenser unit in its shield under the chassis. The condenser may touch the shield due to loose mountings of the entire unit. Insulate to prevent condenser unit from touching shield
Noisy reception, (no plate voltage on first audio tube)	1)	replace the 70,000-ohm, 2-watt resistor (*R14*) mounted on the filter block between terminals *6* and *7*
Noisy reception, (no plate voltage on detector tube)	1)	replace the 500,000-ohm, 1-watt resistor located next to the r-f choke on the resistor panel of the r-f chassis
Noisy reception, (no screen voltage on detector tube)	1)	replace the 1.5-megohm, 1-watt resistor located on the resistor panel of the r-f chassis
Loud roar, disappearing if powerful signal is tuned in	1)	check for "open" condenser, or rosin joint in detector circuit
Rushing noise	1)	faulty '24 tube in one of r-f stages
Audio distortion	1)	"open" ½-meg. *blue* and *green-end* resistor used as grid leak in first a-f stage

RCA R-37, R-37P, R-38, R-38P

See Case Histories for RCA R-28 and R-28P receivers

Inoperative	1)	"open" filter condenser—usually the 4-mfd. unit
Weak reception, Poor control of volume (all parts and voltages check O.K.)	1)	the 0.00025-mfd. plate by-pass condenser on the 2B7 socket touches the diode terminals of the tube socket. Move this condenser away and tape it
Low volume, Distortion	1)	replace the 60-megohm resistor between the first grid and cathode of 2A7 tube
Low volume	1)	defective 10-megohm bleeder, resistors. Replace with 10-watt wire-wound units
Fading out of signal when set warms up	1) 2) 3) 4)	check screen by-pass condenser for lowered capacity or "open" check B-supply by-pass condenser condenser *C17* "leaky" heat of bleeder resistor melting rubber insulation between wire and shield of type '2B7 tube grid lead, causing a short-circuit. Rewire with cotton-insulated wire
Whistling or squealing, Motorboating sound (stops when type '2B7 tube grid cap is touched with the finger)	1) 2) 3)	decrease in capacity of condenser *C30*. Replace with a 4-mfd., 600-volt paper type unit replace 2B7 tube see that shield to second detector grid cap fits tightly in tube shield slot and is well grounded to chassis
Motorboating sound (at all times)	1)	decrease in capacity of screen condenser *C-4*. Replace with a 10-mfd. unit
Motorboating sound (between stations only)	1)	move antenna and ground wires away from the 2A7 tube to the 2A5 side of the 2B7 tube
Constant "popping"	1)	"open" filter condenser—most likely the 4-mfd. unit

RCA R-39

Same Case Histories as those listed for RCA R-35 receiver

RCA BT-40

Distortion, Rattling	1)	speaker cone off-center. This may often be re-centered by bending the support webs of the speaker housing in the required direction

RCA RE-40, RE-40P

See also Case Histories listed for RCA R-28 and RCA R-28P receivers

Interference, Noisy reception	1)	pickup of noise from cable sheath by tuning cable, which is connected to variable condenser rotors. Bond sheath to triangular plate (mounted on rubber) to which sheath is attached

RCA U-40

Push-button tuning mechanism inoperative or works "hard"	1)	chassis slipped down in cabinet. Loosen 3 mounting screws and re-position
Intermittent reproduction on phono	1)	bent pickup-shorting switch on underside of changer
Gear noise in record changer	1)	apply small amount of heavy fibrous gear grease (such as "Texaco Crater Compound No. 2") to spindle pinion and main gear teeth. Do not get this grease near, or into, spindle bearing. Apply the grease while the gear is in motion
Loosening of mounting studs on which the main lever, cam-and-gear, or trip pawl are pivoted	1)	see remedy for this trouble listed under Case Histories for RCA VA-15
Compensation change	1)	if resistor *R-16* is 8,200 ohms, change it to 3,900 ohms

RCA Radiola 41

Inoperative	1) 2)	shorted filter cond. in block power pack open voltage-divider resistor, or change in value of one of its sections
Line fuse blows	1)	short-circuited rectifier stack sections
Broad tuning	1)	reduce value of grid suppressors
Choked reception, Distortion, No output tube bias voltage	1)	short-circuited type '210 tube bias resistor by-pass condenser
Whistling or squealing	1) 2) 3) 4)	shunt 100,000-ohm resistor across 3rd r-f transformer primary increase value of grid suppressors look for "open" 1,000-ohm grid suppressor resistor in second or third r-f grid circuits place closed loop of insulated wire near r-f coil
Intermittent hum	1)	put set in operation and temporarily "short" plus B to minus B with a screwdriver. Repeat this several times
Hum	1) 2) 3)	partially "shorted" section or sections of speaker rectifier stacks volume control arm not making contact poor ground connection to speaker frame

(Cont'd)

RCA Radiola 41—*(Cont'd)*

Strong hum	1)	remove ground connection to speaker frame
Noisy reception	1)	corroded volume control resistance element and contact arm
	2)	loose volume control contact arm
	3)	noisy audio transformer primary
Choked signals	1)	"shorted" by-pass condenser across bias resistor for 10 tube. It is located in the power pack
Microphonic howl, Low audio howl	1)	"open" by-pass condenser across secondary of first a-f transformer. If replacement is not available, remove the "open" condenser and connect a 0.00025-mfd. fixed condenser from the grid of the first a-f tube to the chassis

RCA BK-42

Improving performance of oscillator	1)	if oscillator grid resistor *R-1* is 220,000 ohms, change it to a 150,000-ohm unit

RCA BT-42

Distortion at high-volume settings	1)	try new 1H5G tube
Improving performance of oscillator	1)	if oscillator grid resistor *R-1* is 220,000 ohms, change it to a 150,000-ohm unit
Dial drive slips	1)	chassis mounted too far into cabinet, causing dial pointer to rub against cabinet
	2)	cord drum bent and touching chassis
	3)	dial cord rubbing against parts in chassis
	4)	tuning condenser bearing too stiff
Dial cord breaks	1)	machined surface at drive pulley is rough
	2)	rough surface on guide rivets
	3)	dial cord rubbing against head of guide pin rivets due to poor alignment between rivets and dial cord drum
	4)	guide pin rivets should be flush with mounting plate and tightly riveted

RCA Radiola 42

See also Case Histories listed for RCA Radiola 48 receiver

Inoperative, Weak reception, Noisy	1)	burnt-out volume control. If control is in this condition, check the r-f tubes for screen-to-plate "shorts"

RCA U-42

Rattling, or loud bass passages	1)	inspect loop antenna for loose mounting. Fasten securely
Gear noise in record changer	1)	see remedy for this Trouble Symptom listed under Case Histories for RCA U-40 receiver
Loosening of mounting studs on which main lever, cam-and-gear, or trip pawl are pivoted	1)	see remedy for this Trouble Symptom listed under Case Histories for RCA VA-15 receiver
Compensation change	1)	if resistor *R-16* measures about 5,600 ohms, change it to 2,700 ohms

RCA R-43

Erratic operation	1)	"low" B-batteries. Replace when battery voltage (with set turned on full) drops to less than ¼ of normal voltage
Distortion at high-volume	1)	"shorted" turns on one side of the primary of the input push-pull audio transformer *No. 7265*. Check this by inserting a milliammeter in each of the push-pull tube plate leads and compare the current peaks on loud signals. Any marked difference indicates a faulty transformer—which should be replaced
Weak reception, Whistling or squealing	1)	replace resistor *R-4* with a 15,000-ohm 5-watt unit; replace resistor *R-1* with a 8000-ohm 1-watt unit. Clean and adjust tuning condenser rotor springs. Realign entire unit

RCA U-43

Circuit improvement	1)	shunt a 0.1-mfd. condenser (Stock *No. 4839*) across electrolytic condenser *C-23* to reduce possibility of breakdown
Loosening of mounting studs	1)	—(on which main lever, cam-and-gear, or trip pawl, are pivoted). See remedy listed under Case Histories for RCA VA-15 receiver

RCA Q-44

Weak reception	1)	mica condensers in 3rd i-f transf. can should *not* touch each other

RCA Radiola 44

Same Case Histories as those listed for RCA Radiola 46 receiver

RCA U-44

Inoperative	1)	"shorted" 0.005 by-pass condensers from 6F6 plates to chassis. Use 600-volt replacement units
Loosening of mounting studs on which the main lever, cam-and-gear, or trip pawl are pivoted	1)	see remedy for this Trouble Symptom listed under Case Histories for RCA VA-15 receiver
Compensation change	1)	if resistor *R-24* is 8,200 ohms, change it to 5,600 ohms

RCA-Victor RE-45

See also Case Histories listed for RCA R-32 receiver

Inoperative on "radio" but O.K. on "phono"	1)	faulty dual volume control. Check for this by applying a signal to one of the '26 tube grids. If this is the trouble, the set will operate and the volume control will appear to work O.K., but one of the dual sections will be found faulty
O.K. on "radio," but weak on "phono" (pickup unit and matching transformer O.K.)	1)	high-resistance contact in the radio-phono switch. Clean these contacts well
O.K. on "radio" but weak on "phono" (phono pickup output weak)	1)	shift pickup magnets together as close as possible by squeezing with pliers
	2)	adjust armature. If damping rubbers have hardened, replace them
Chassis "shorts"	1)	often caused by steel phono needles falling down from phonograph compartment and "shorting" the socket lugs to ground

RCA U-45

Loosening of mounting studs on which the main lever, cam-and-gear, or trip pawl are pivoted	1)	see remedy for this Trouble Symptom listed under Case Histories for RCA VA-15 receiver

RCA 45X1, 45X2

Inoperative	1)	"open" resistor in series with tube filaments
Intermittent reception	1)	partial "short" in primary windings of output transformer
Improvements for 1st Product. receivers	1)	change *R-8* from 150 to 120 ohms
	2)	change *R-4* from 2.2 to 3.3. megs

RCA 45X-11, 45X-12, 45X-13

Microphonic howl	1)	due to vibration of parts in the oscillator circuit. See that drive pulley does not touch dial. Squeeze in the rear of the gang condenser frame, in order to center the rotor plates within the stator. Loosen tuning condenser mounting screws slightly to ensure free floating for the gang
Hum in 1st Production receivers	1)	connect diode plate No. 1 to chassis instead of to diode plate No. 2
To provide more effective i-f filtering in 1st Production receivers	1)	connect condenser *C-13* to 12SQ7 grid instead of to arm of volume control

RCA Radiola 46

Inoperative (no screen-grid voltage)	1)	"shorted" r-f by-pass condenser
	2)	"short" between volume control shaft and chassis. Check the insulating washer on the shaft
	3)	"open" 0.01-mfd. audio coupling condenser
Intermittent reception	1)	replace speaker coupling condenser with a 1-mfd. 600-volt unit. (Condenser is located under the socket power unit)
	2)	corroded radio-phono transfer-switch prong, the other prong making good contact. Clean the prong and bend it to increase its tension
Fading on local if a-c switch snapped on-off	1)	poor contact on phono switch through which plate supply of first and second r-f tubes feeds through. Replace with new switch
Fading on locals	1)	corroded center friction contact of volume control arm
Fading	1)	"open" speaker coupling condenser. Replace with 1-mfd. 600-volt unit
	2)	"open" 0.1-mfd. 300-volt screen-grid by-pass condensers
Weak reception on low-frequencies	1)	wear of tuning condenser bearings will allow shaft to slip sidewise, throwing the tuning stages out of alignment
Weak reception (low or no detector plate voltage)	1)	"ground" in the coupling choke in the plate circuit of the detector tube (this part is located in the small brown housing under the r-f chassis). Slip a piece of insulating paper between choke and chassis
Weak reception (no r-f screen voltage)	1)	volume control slider arm not making contact
	2)	shaft of volume control "shorting" to chassis

(Cont'd)

RCA Radiola 46—*(Cont'd)*

Weak reception	1)	if whistles or squeals are also heard at the low frequencies, realign condenser gang
Weak reception, Stations do not tune at particular settings on the tuning dial	1)	expansion of chassis causing tuning condensers to be forced out of line. Repair by reaming the holes in the bakelite plates which hold the stators, so as to enable the aligning of the tuning condenser plates exactly
Difficulty in aligning	1)	"shorted" turns on the small universal-wound plate coil. Replace
	2)	replace first (unshielded) r-f coil which is frequently affected by moisture
Broad tuning, Set does not tune to settings on the tuning dial, especially at the high-frequency settings	1)	worn rotor bearings, allowing rotor to slip slightly in a side direction, thus changing the tuning condenser capacity and throwing the set out of alignment. Realign the rotor plates and tighten them in position
	2)	realign the trimmers at the high-frequency setting of the tuning dial
Whistling or squealing	1)	antenna load too small. Connect a 0.001- or 0.005-mfd. condenser from antenna to gnd. Realign ant. stage
	2)	loose condenser gang. Tighten
Whistling or squealing and noise when tuning	1)	clean tuning condenser wipers, and tuning condenser shields where they fit into chassis base
Whistling or squealing, Noisy	1)	check all contacts made by the stage shields and their supporting framework. Clean thoroughly
	2)	poorly soldered connections on r-f coils
	3)	leads on r-f chokes (inside of coil) "shorting"
	4)	"open" r-f by-pass condensers
	5)	try new r-f tubes
	6)	adjust compensators which are situated in front of the condenser gang
Hum	1)	connect an 8-mfd. dry electrolytic condenser across the speaker field or from one side of the speaker field to ground. This will cure the trouble
	2)	remove detector cathode wire running to power pack, and ground the cathode with a 10,000-ohm resistor. By-pass this resistor to ground with a 4-mfd. condenser
Hum, Insensitive	1)	add a 4-mfd. electrolytic condenser between field lug and "ground"
	2)	variable condenser stator plates off-center
Hum	1)	re-center or replace speaker cone if hum disappears when it is held

RCA U-46

Inoperative	1)	check for internal "ground" in voltage divider
Fading	1)	"open" or "leaky" 0.0025-mfd. condenser *C-31* connected from "high" end of volume control to accessory tone control switch
To increase "bass" response in Early-run receivers	1)	replace 82,000-ohm resistor *R-11* with a 56,000-ohm unit (Stock *No. 12286*). Replace the 0.035-mfd. condenser *C-33* with a 0.01-mfd. unit. Replace the 0.05-mfd. condenser *C-51* with one of 0.025-mfd.
Gear noise in record changer	1)	see remedy for this Trouble Symptom listed under RCA U-40 receiver

RCA 46X SERIES (Models 46X-1, -2, -3, -11, -12, -13, -21, -23, -24)

In case of frequent dial lamp burnout replace with Mazda No. 51 (0.2 amp.) instead of Mazda No. 47 (0.15 amp.)

RCA 46X-1, 46X-2

Noisy reception	1)	check for leakage between filter condenser sections. Replace condenser
Microphonic howl	1)	see remedies for this Trouble Symptom listed under RCA 45X-11 receiver

RCA 46X-3 (Chassis 459B)

Inoperative	1)	check for "open" in tube filament circuit—even if dial lamp lights up (dial lamp is not in series with tube filament circuit but has its own separate voltage-dropping plug-in resistor)
Microphonic howl	1)	see remedies for this Trouble Symptom listed under RCA 45X-11 receiver

RCA 46X-11, 46X-12, 46X-13

Inoperative	1)	"open" oscillator coil. If windings are O.K., resolder all coil joints
Weak reception	1)	check first i-f transformer for increased resistance of windings. Replace
Antenna circuit change in Early-run receivers	1)	remove 68-mmfd. condenser *C-1*, and make a through connection from terminal *No. 3* on the antenna terminal board to terminal No. 2 on the loop

RCA Radiola 47

Same Case Histories as those listed for RCA Radiola 46 receiver

RCA Radiola 48

Inoperative, or intermittent	1)	check detector plate choke under oblong shield at right of tuning condenser
	2)	check r-f choke under shield at left of tuning condenser
Inoperative (negative potential on det. plate)	1)	shorted 2-mfd. filter condenser between the center-tap of filter choke, and terminal No. 6
No r-f screen voltage	1)	"open" r-f choke in screen circuit
Intermittent reception, Fading	1)	examine plates of variable condenser for filings or other foreign matter. Blow out with air pressure—or burn out with high voltage
	2)	corroded variable condenser clips. Clean, adjust—or install pigtails
	3)	burnt-out section of volume control. Secure a new control unit. The screen grid section of the new control has a different value from the old one, and has a reversed taper. This necessitates reversal of the two outside connections on the screen potentiometer and removal of the 12,000-ohm gray resistor which shunts the section of the volume control. Before removing the old control, draw yourself a picture diagram showing the position of the wires. This will prevent any difficulty in installing a new control. Check r-f '24 tubes for plate-to-screen "shorts" to prevent repetition of the trouble

(Cont'd)

RCA Radiola 48—*(Cont'd)*

Excessive plate voltage and current in the output stage, Excessive screen-grid and plate voltages on the r-f tubes	1)	one of the filter choke leads connected to the high-voltage center-tap of the power transformer grounding to case. This results in application of the full unfiltered voltage from the rectifier tube to all the tube circuits. Insert a change in value, and intermittent "opens" or "shorts"
Choked reception, Distortion, Hum, Positive grid bias on type '45 tubes, Weak reception	1)	short-circuited 0.025-mfd. audio coupling condensers
	2)	faulty 430,000-ohm resistor from grid to chassis in '45 tube push-pull output stage
Noisy tuning, Intermittent reception	1)	plating peeling from variable condenser plates. Burn with high voltage—all leads disconnected
	2)	corroded gang-condenser rotor shaft clips
Whistling or squealing	1)	corroded gang-condenser rotor shaft clips
	2)	check by-pass condensers
	3)	in severe cases, install additional 300 to 700-ohm resistor in series with common r-f cathode connection where it joins the tap between the 120 and 830-ohm sections of the voltage divider
Noisy volume control	1)	bunching up of resistance wire on volume control. Replace—(see note concerning new volume controls for this receiver under "Intermittent reception, Fading")
Hum on phonograph records	1)	shunt a 5,000-ohm resistor across the secondary of the phono-pickup input transformer
Hum (steady)	1)	replace '24 detector tube

RCA O-50

To increase Victrola gain	1)	the over-all amplification of this model, when used as a Victrola, is limited by the voltage-divider circuit comprised of a resistor in series with, and a capacitor across the pick-up circuit. Values of these components are established on the basis of (1) average available voltage output from pickup under average climatic conditions, (2) degree of "rumble" likely with given amplification, (3) danger of "microphonic howl" with high amplification, and (4) possible consumer reaction to overload occurring at a low volume control setting with heavily cut records. If these points are kept in mind, additional gain may be obtained, wherever desired, by decreasing the value of the pickup shunt capacitor; *O-1* in Model O-50 and *O-32* in Model U-50. The substitute capacitor should be approximately ¼ to ½ the value of the original.

RCA Radiola 50

See also Case Histories listed for Radiola 17 receiver

Fading (switching power off momentarily appears to clear up the trouble)	1)	faulty AVC tube. Replace with '27 type tube
	2)	it may be necessary to cut down the filament current to some extent (as by connecting in a series resistor of correct value) to obtain the proper AVC tube emission
Fading shortly after set is turned on, but removing AVC tube restores it to normal	1)	leaky by-pass condensers in AVC circuit. Replace *C32*, *C34* and *C35*

(Cont'd over)

RCA R-50—*(Cont'd)*

Distortion	1)	replace the 110,000-ohm resistor from B-plus to cathode of second detector. This resistor decreases in value and supplies excess bias voltage to this tube
Improving tone quality	1)	remove present tone compensator (consisting of an 18,000-ohm resistor in series with a 0.005-mfd. condenser) connected from plate to plate of output pentode tubes

RCA R-50

Inoperative (set plays only when '27 AVC tube is withdrawn)	1)	check for "open" resistor in AVC return
	2)	check for high-negative bias on r-f and i-f control grids
Inoperative (no plate voltage on 2nd det. tube)	1)	"open" primary winding in push-pull input transformer
Inoperative, Intermittent reception	1)	replace 0.1-mfd. section of condenser in power pack, which is connected to 1-megohm resistor
	2)	replace the 0.5-mfd. section of the above unit, which is connected to the 40,000-ohm resistor
	3)	open-circuited voice-coil connection, caused by loosened connecting screws on terminal strip behind the speaker power unit
Weak reception (all voltages O.K. and signal increases appreciably if finger is placed on control grid of 1st detector)	1)	"open" 15-ohm flexible pigtail resistor connected in series with 1st det. trimmer condenser across the 1st det. section of the gang condenser
Weak reception (signal increases appreciably if '27 AVC tube is withdrawn)	1)	disconnect 0.1-mfd. condenser in power pack (fastened to one end of 1-meg. resistor and usually wired with a *blue* lead). Connect a new condenser from this point to ground
Weak reception (cannot peak 1st det. stage)	1)	"open" trimmer series condenser in this stage
Reception of powerful local stations only, (voltages check O.K.)	1)	substitute a 0.1-mfd. condenser between the *blue* and *black* leads, located in the capacitor pack mounted on the separate power unit
	2)	high resistance leakage somewhere (about 0.1-meg.) upsetting AVC circuit
Lack of sensitivity, Low-frequency end of dial off calibration	1)	loss of capacity in oscillator padding condenser. Shunt a small mica condenser across this trimmer or replace the padding condenser
Intermittent operation	1)	"open" voice coil circuit due to loosening of terminals *4* and *5* on the terminal strip behind reproducer unit. Tighten all these terminals securely
Whistling or squealing	1)	open-circuited 0.1-mfd. screen by-pass condenser
Fading	1)	open-circuited 0.1-mfd. screen by-pass condenser across resistor in AVC circuit (located in power pack and connected to *blue* lead from condenser block

(Cont'd)

RCA R-50—*(Cont'd)*

Fading (tubes and voltages test O.K.) (sharp increase or decrease in volume without any change in the volume control setting when the receiver is turned on again after having played some time at moderate volume)	1)	reduce the heater voltage of the type '27 AVC tube to about 1.5-volts by means of filament resistors
	2)	snapping of connecting tabs of the leaf-clamp type oscill. series condenser which is connected across oscillator padder. Install new unit
	3)	try new '27 AVC tube
Distortion and weak reception	1)	"open" primary of interstage transformer (winding with *yellow* lead). Disconnect *yellow* lead from *No. 5* terminal on 8-terminal strip of power pack and test continuity
	2)	if plate voltages on all tubes are low, check for carbonized voltage divider network resistors (composed of a 14,000-ohm 2-watt unit, a 10,000-ohm 1-watt unit, and a 170-ohm 1-watt unit) all carbon resistors mounted on the terminal strip fastened to rear wall of tuner chassis. Replace with wire-wound units of higher wattage rating
Distortion at resonance	1)	insufficient AVC voltage as result of leakage of plate-cathode by-pass condenser in AVC stage
Static-like noise with volume control in "off" position	1)	breakdown of interstage transformer, which shows up only when set is heated. Replace complete interstage output assembly
	2)	defective a-f input transformer
	3)	defective first i-f transformer
Hum	1)	open-circuiting of the tapped section of first filter choke. Receiver may be repaired by installing a jumper across the open-circuited portion of the choke

RCA U-50

To increase Victrola gain	1)	see instructions for this listed under Case History for RCA O-50. (Value of original condenser *C-32* in the U-50 receiver in 0.015-mfd.)

RCA Radiola 51

Same Case Histories as those listed for RCA Radiola 18 receiver

RCA-Victor R-52

Same Case Histories as those listed for RCA-Victor R-32 receiver

RCA BP-55

Weak reception, Distortion	1)	premature loss of emission of 1T5GT output tube. Replace
Hum	1)	"intermittent" or "open" common connection or contact between electrolytic condenser and chassis. Solder securely, or add a jumper from the electrolytic ground lug to lance on chassis

RCA R-55

See also Case Histories listed for RCA R-50 receiver

Fading	1)	check 0.0024-mfd. condenser across plate and cathode of the AVC tube for "open" or "leaky" condition
	2)	high "leakage" in condenser by-passing the control-grid return of the AVC tube (condenser is located in power pack)
Poor tone	1)	remove 18,000-ohm resistor and 0.005-mfd. condenser (which form a tone compensator) from plate to plate of the output pentode tubes

RCA T-55

Hum	1)	reverse either the voice coil leads or the two leads to the hum bucking coil of the speaker

RCA BP-56

Same Case Histories as those listed for RCA BP-55 receiver

RCA QU56C, QU56M

Whistling or squealing	1)	connect a 1,000 ohm resistor in the $B+$ lead of the 6SA7 first det-osc. plate circuit. By-pass this resistor to ground with a 0.05-mfd. condenser

RCA RE-57

See also Case Histories listed for RCA-Victor R-35 receiver

Inoperative	1)	remove panel-mounting rivets carefully. Turn panel over, and check value of 2-watt resistor in detector circuit. It should be 1 or 1.5 megohms. If it has changed value, replace it
Intermittent radio-phono operation	1)	corroded contact segments in master transfer switch
Insufficient power for recording	1)	try transposing the *black* and *black-with-red-tracer* wires which are connected to the two terminals in back of the amplifier

RCA RAE-59

See also Case Histories listed for RCA R-50 receiver

Intermittent reception, Low phono volume	1)	corroded contact segments in radio-phono transfer switch
Flat tone quality from near-by local stations	1)	over-control by AVC circuit. Insert a 300,000-ohm resistor in series with the 50,000-ohm resistor, connected from plate of AVC tube to ground, at the *ground* side. Remove *r-f* and *i-f* leads from plate of AVC tube to the junction of both resistors, by-passing them with a 0.25-mfd. condenser

RCA K-60

Whistling or squealing, Instability	1)	check converter tube socket
	2)	improper i-f alignment. Realign for "symmetrical" wave shape as shown on an oscillograph, rather than from maximum "peak" output
Improving reception on "C" band	1)	connect an antenna (with a 1,000-mmfd. condenser in series) directly to "C" band loop, 2 or 3 inches from "low" end of loop

RCA Radiola 60

House fuse blows (Model 62)	1)	"shorted" sections in loudspeaker rectifier stacks (speaker field voltage should be about 105 volts)
	2)	"shorted" 4-mfd. condenser across output of speaker rectifier
Inoperative, or low volume (low plate voltage)	1)	check resistance of *black* carbon 20,000-ohm bleeder resistor in pack for decreased value. Replace with 3 or 5-watt unit
	2)	"open" i-f coil winding
Inoperative above 600 kc, Dial setting incorrect	1)	snapped tabs on oscillator series condenser
Weak, unsteady reception (Model 60)	1)	replace oscillator grid condenser with a condenser of approximately 750-mmfd.
	2)	check the 40,000-ohm oscill. grid leak
	3)	check the 3,000-ohm harmonic suppressor between grid leak and stopping condenser. Try increasing its value to 6,000 ohms
Weak reception (low plate voltages)	1)	change in value of the *black* carbon 20,000-ohm bleeder resistor in pack. Replace with 3 or 5-watt unit
Weak reception	1)	poor contact of tubes with their sockets
	2)	i-f amplifier needs realigning
	3)	shunt 400-ohm section of flat wire-wound voltage divider near volume control with 500-ohm unit
Weak reception (unable to peak i-f transformers)	1)	poorly soldered connections and disconnected trimmers
	2)	shorted i-f windings (primaries should have resistance of 20 ohms)
Intermittent reception, Fading	1)	"open" secondary in audio coupling transformer
	2)	faulty 20,000-ohm *black* carbon bleeder resistor in power pack. Replace with 3 or 5-watt unit
Distortion	1)	partially or fully "shorted" pilot light socket. If socket checks O.K., try a new pilot light bulb
	2)	"open" a-f transformer primary
Distortion at low volume	1)	broken spider or speaker cone
Whistling or squealing all over dial	1)	connect a 0.05-mfd. condenser from the i-f B-plus terminal in the power pack to chassis
	2)	readjust neutralizing condensers and tuning condensers of i-f coils. To do this, variable condenser tube must be removed
	3)	try connecting a 0.001-mfd. condenser across secondary of first a-f transf.
	4)	"open" oscillator grid leak
Noisy reception	1)	faulty r-f plate choke in r-f transformer assembly
Hum (in Model 62 receiver)	1)	partially "shorted" speaker rectifier stacks
	2)	try removing ground connection to speaker frame
	3)	"open" centertapped filament resistors
	4)	"grounded" pilot light bracket
	5)	"open" grid returns
	6)	check condenser across speaker field supply
	7)	faulty speaker rectifier unit
Mechanical hum	1)	remove the '80 rectifier tube. If the hum persists, it is caused by loose power-transformer laminations. Remove transformer from chassis and heat in a "slow" oven until the sealing compound becomes fluid and adheres to the transformer laminations. Allow to cool thoroughly before placing back into receiver

(Cont'd over)

RCA Radiola 60—*(Cont'd)*

Steady howl or hiss (Model 60)	1)	try new tubes
	2)	check the 40,000-ohm resistor and 0.0024-mfd. condenser in the 2nd detector plate circuit
	3)	try reversing primary leads to first a-f transformer if howl exists only when set is first turned on
Station heterodyning whistle	1)	connect a 0.001-mfd. condenser across the secondary of the first-audio transf.
No control of volume	1)	faulty '71A tube. Replace

RCA X-60

Weak reception on short-waves	1)	add capacity coupling of 3 or 4-mmfd. between signal and oscillator grids of converter tube. This coupling can be effected in several ways: (a) Unsolder one grid lead, take several turns around other lead to give desired capacity, resolder (b) Twist several turns of insulated wire around both grid leads to give desired value of capacity coupling (c) Install a 3 to 4-mmfd. capacitor between tube grids

RCA K-62

Same Case Histories as those listed for RCA K-60 receiver

RCA Radiola 62

See also Case Histories listed for RCA Radiola 60 receiver

Inoperative (low plate voltage, high grid bias on all tubes)	1)	"shorted" mica by-pass condenser connected from second detector plate to ground
Intermittent reception	1)	"open" i-f transformer. Remove tuning condenser gang to get at i-f coil cans for removal and replacement

RCA Radiola 64

See also the Case Histories listed for RCA-9 receiver

Inoperative, Tuning meter not working	1)	open-circuited 3,850-ohm section in resistor block in chassis
	2)	open-circuited section of voltage-divider
	3)	inoperative volume control
Inoperative	1)	shorted filter condenser in block
Intermittent reception, Fading	1)	inspect for "snapped" connecting tabs on oscillator series trimming condenser
Weak reception	1)	poor contacts at tube sockets
	2)	incorrect alignment of i-f stages
Hum	1)	interaction between the speaker field power supply and the receiver power supply. Remove the terminal shield between them, thereby eliminating their common connection
Mechanical hum	1)	see the Case History listed for this Trouble Symptom for Radiola 60, 62 sets

RCA Radiola 66

Inoperative (tubes and voltages test O.K.), Oscillator signal cannot pass through second detector stage	1)	open-circuited primary coil in last i-f transformer (has a 7,000-ohm resistor shunted across it)

(Cont'd)

RCA Radiola 66—*(Cont'd)*

Inoperative (except at one critical spot on volume control)	1)	"open" volume control resistor strip
Inoperative (no plate voltages)	1)	replace 4,800-ohm resistor in the bottom of the power unit chassis
Inoperative (loud hum)	1)	"shorted" 0.0024-mfd. by-pass condenser across plate and cathode lugs underneath 2nd detector socket
Intermittent reception accompanied by hum	1)	inspect to see if movable arm of volume control is making proper contact with resistance strip. Bend back into place
Fading, Intermittent reception, Dial settings shift, Inoperative below 600 kc	1)	snapped tabs on oscillator series condenser
	2)	"open" 250,000-ohm resistor between secondary of last a-f transformer and "B" minus
Insensitive at high or low-frequencies	1)	oscillator trimmers out of adjustment
	2)	r-f compensating condenser out of adjustment
	3)	poorly soldered connections or "shorts" in i-f coil windings or trimmers
Insensitive at high-frequencies	1)	if this persists after receiver has been balanced and neutralized it is likely due to incorrect alignment of the first detector and r-f tuning condenser. These circuits have no trimmers. In order to correct this trouble, it is advisable to bend the plates of the tuning condenser gang because of lack of clearance and danger of "short." Install two very small trimmers across the r-f and first detector section of the tuning condenser gang. After adjusting these trimmers to peak, a great improvement in sensitivity in the high-frequency end of the dial will be obtained
Distortion	1)	"open" 250,000-ohm resistor in a-f transformer secondary-return circuit
	2)	check for grease in volume control, placed there at factory and often working into and under movable contact plate. Remove and clean
	3)	if accompanied by a shrill note, check the 40,000-ohm resistor connected from 0.05-mfd. condenser to 2nd detector plate
Distortion at high volume	1)	remove wire between the cathode of the second detector tube and cathode of oscillator tube. Insert a 30,000-ohm resistor between the second detector cathode and ground
Whistling or squealing, Unstable operation	1)	remove 6,000-ohm *yellow* resistor at one end of the bias resistor attached to the chassis. Replace it with a unit of higher resistance value—just enough to prevent oscillation and instability
Whistling or squealing (over entire tuning range)	1)	re-neutralize, or replace i-f transformer
Whistling or squealing (at high-frequency end of scale)	1)	unscrew r-f compensators slightly

(Cont'd)

RCA Radiola 66—*(Cont'd)*

Whistling or squealing (on some stations and not on others)	1)	image-frequency interference due to r-f stages being out of balance
Noisy reception, Intermittent operation	1)	loose or oxidized socket contacts
Mechanical hum	1)	see Case History listed for this Trouby Symptom under Radiola 60, 62 receivers
Hum	1)	connect a 8-mfd. dry electrolytic condenser from either leg of the filament of the '80 rectifier to ground
Hum (in console sets)	1)	if hum disappears when cone is held, check for off-centre cone

RCA Radiola 67

See also Case Histories listed for Radiola 64 receiver

Inoperative, Steady sputtering (all plate and filament voltages O.K.)	1)	dirty contacts in phono-radio switch. This removes bias from the AVC tube, which in turn causes a high bias on the controlled tubes. Clean switch contacts
Inoperative	1)	open-circuited 115-ohm voltage divider section
	2)	open or corroded contacts of phono-radio transfer switch
	3)	open-circuited 1-megohm AVC grid resistor
Inoperative, Tuning meter needle off scale	1)	open-circuited 100-ohm section of voltage divider
Weak reception	1)	poor contacts of the tubes with their sockets
	2)	i-f stages out of alignment
Fading	1)	corroded contacts on phono-radio transfer switch
Whistling or squealing	1)	"local-distance" switch, on "local" side, cutting out the aerial. In some localities the aerial is necessary in the circuit and must be connected
No control of volume	1)	open-circuited 310-ohm end section of voltage divider in tuning chassis. Replace with 25-watt resistor
Loud hum	1)	place wads of felt on the speaker cone to muffle the 60-cycle hum

RCA RAE-68

Cannot be switched on	1)	copper contacts on relay burned away
Cannot be switched off	1)	relay arm welded to copper contacts of relay
Inoperative below 600 kc	1)	snapped tabs on oscillator series condenser
Weak reception, Slight distortion, Volume control must be turned to maximum	1)	screen-drop resistor carbonized to low value and screen-cathode bleeder carbonized
Fading, Intermittent reception, Shifting of station dial settings	1)	snapped tabs on oscillator series condenser

(Cont'd)

RCA RAE-68—*(Cont'd)*

Distorted reproduction, Hum	1)	open-circuited 60,000-ohm resistor in push-pull input transformer secondary return circuit
Distortion, Low volume	1)	open-circuited audio transformer primary
Poor control of volume	1)	remove 6,000-ohm resistor from across volume control
Chattering of tuning control when "remote" is used	1)	adjust friction screw
Automatic phono mechanism troubles	1)	see Case Histories listed for RCA-Victor RAE-79

RCA R-71, R-72

Sharp volume cut-off, Whistling or squealing, Station hiss	1)	open-circuiting or open-circuited 0.05-mfd. r-f, first detector and i-f secondary-return by-pass condensers
Weak reception, Station hiss, Whistling or squealing	1)	open-circuiting or open-circuited 0.05-mfd. r-f, first detector and i-f secondary-return by-pass condensers
Motorboating sound between stations, Distorted, Poor control of volume	1)	leaky 0.05-mfd. r-f first detector and r-f secondary-return by-pass condensers
Noisy tuning, Whistling or squealing, Motorboating sound between stations	1)	corroded condenser-gang rotor contacts. Solder flexible pigtails between rotors and condenser frame
Noise and whistling or squealing (while tuning)	1)	clean wipers on gang condensers
Noisy volume control	1)	clean resistance element with alcohol
Sudden change of tone	1)	clean resistance element of tone control with alcohol

RCA R-73 (with 47's)

Intermittent reception, Whistling or squealing, Motorboating sound	1)	dirty contact between rotors of tuning condensers and chassis. Clean and adjust all rotor wiping contacts
	2)	faulty 0.05-mfd. condenser by-passing first detector, and i-f secondary returns
Fading, Intermittent reception, Station hiss, Whistling or squealing	1)	decrease in value of one of the 0.05-mfd. by-pass condensers in the secondary return circuits of the r-f, first detector and i-f stages. Replace if the value is lower than rated. This is usually due to a high-resistance connection at the condenser terminal or an internal "open"
	2)	"open" 10-mfd. 55 second detector cathode by-pass condenser
	3)	intermittently open-circuiting condenser in one of the secondary return circuits. Test by flashing with high a-c voltage. Replace all condensers which break down
	4)	replace 50,000-ohm resistor under the r-f coil with a 60,000-ohm unit. Resolder all oscillator coil connections

(Cont'd over)

RCA R-73 (with 47's)—*(Cont'd)*

Weak reception	1)	sensitivity can be improved by soldering a short length of insulated wire to the grid cap of the first detector. Wrap the other end around the grid lead of the first r-f tube. This supplies regeneration to the r-f stage, increasing the gain. No direct connection to the r-f grid is necessary. The resultant capacity of 5 or 6 turns around the grid lead is sufficient
	2)	check the three 0.1-mfd. by-pass condensers in the AVC circuit
Weak, Distorted reception	1)	open-circuited 60,000-ohm resistor in push-pull input transformer secondary return circuit
	2)	open-circuited 0.2-mfd. a-f blocking condenser
Distortion, Poor control of volume, Motorboating sound, Squealing or whistling	1)	leaky 0.05-mfd. r-f, first detector and i-f secondary-return by-pass condensers
Noisy tuning, Squealing or whistling, Motorboating sound between stations	1)	corroded condenser-gang rotor contacts. Solder flexible pigtails between rotors and condenser frame

RCA R-73A (with 2A5's)

Same Case Histories as those listed for RCA R-73 (with 47's) receiver

RCA R-74

Intermittent reception, Inoperative	1)	open-circuiting or open-circuited 0.1-mfd. audio coupling-condenser
Fading, Sharp drop in volume, Weak reception, Station hiss	1)	open-circuited 0.05-mfd. r-f, first detector and i-f secondary-return by-pass condensers
Poor control of volume, Distortion, Distortion at resonance	1)	open-circuited screen-grid or cathode by-pass condenser. Replace with new unit
	2)	open-circuited first detector 0.05-mfd. grid filter condenser connected between the secondary winding of the second r-f transformer and ground, located to the left of the volume control. Replace with new unit *Note*: the same trouble also occurs in similar condenser located in the i-f or r-f stages; the former being connected near the antenna coil; the latter near the second i-f transformer
Noisy tuning, Whistling or squealing, Motorboating sound between stations	1)	corroded condenser-gang rotor contacts. Solder pigtails between rotors and condenser frame
Hum when stations are tuned in	1)	cathode "shorts" in the type 56 and 58 tubes, caused by high voltage surges on fluctuating line -voltages. Install voltage regulator resistors to prevent wide voltage variations
Whistling or squealing	1)	"open" 10-mfd. condenser with *yellow* lead connecting the volume control lug. (*Note*: watch the polarity in replacing, as the ground in this receiver is *positive*.)

RCA R-75 (with 47's)

Intermittent reception	1)	check 0.05-mfd. condenser by-passing the r-f, first-detector and i-f secondary returns
Fading	1)	check 0.1-mfd. condenser in first-detector circuit
	2)	check all other small condensers in the r-f circuit
Intermittent fading	1)	replace all three of the 0.05-mfd. condensers in the grid returns of the r-f, detector and i-f tubes

RCA R-75 (with 2A5's)

Same Case Histories as those listed for RCA R-75 (with 47's) receiver

RCA-Victor RE-75

Whistle in background on all stations (reception otherwise O.K.)	1)	"open" 500,000-ohm resistor across half of secondary winding of interstage push-pull audio transformer

RCA R-76

See also Case Histories listed for RCA R-74 receiver

Intermittent reception	1)	check antenna stage by-pass condenser *C-1*
Noisy volume control	1)	clean resistance element with alcohol
Noise and whistling or squealing (while tuning)	1)	clean wipers on gang
Hum modulation on strong signals	1)	check AVC filter condenser *C-38*, and other filter condensers
Sudden change of tone	1)	clean tone-control resistance element with alcohol
Whistling or squealing	1)	"open" 10-mfd. condenser with *yellow* lead connected to lug on volume control. (*Note*: watch polarity in replacing, as "ground" in this receiver is *positive*)

RCA AR-77

Dial shutter control cord slips off its idler pulleys	1)	the RCA Stock *No. 36400* kit of parts, when properly installed, will effectively prevent this from taking place. Installation is a simple matter and may be completed quickly: (a) Disconnect the receiver from the power supply line (b) Remove the hardware and the wire lead from each of the two outer terminal posts at the rear of the "S" meter (c) Mount one of the fishpaper supports (by means of one of the punched holes) on each of terminal posts (d) Replace the lead and the hardware belonging to each terminal post (e) Install the short spring between the "S" meter fishpaper support on the right (when facing the rear of receiver) and the black shutter control cord (f) Attach the coil end of the long spring to the meter support on the left (when facing rear of receiver), and the straight end to the black shutter control cord

RCA R-77

See also Case Histories listed for RCA R-74 receiver

Intermittent volume, Removal of AVC tube has no effect on volume	1)	high-resistance short-circuits between condensers *C38*, 10-mfd., 200-volts; *C21*, 0.5-mfd., 600-volts; *C19*, 0.1-mfd., 600-volts; *C36*, 10-mfd., 400-volts; *C35*, 10-mfd., 400-volts
Fading	1)	"open" 0.05-mfd. by-pass condenser in r-f, i-f, or 1st detector stage. Bridge across each one in turn with a 0.05-mfd. unit to locate the faulty one
Rushing or "shussing" sound at resonance, Station hiss	1) 2) 3)	antenna too short open-circuit in the antenna system decrease in capacity of the 0.05-mfd. condenser in one of the i-f secondary return circuits to about 0.008-mfd. This condenser is in the AVC circuit
Noisy reception at the high-frequency settings of the tuning dial	1) 2)	AVC action too pronounced. Reduce the heater voltage of the type '56 AVC tube by inserting a small filament resistor in one leg of the heater circuit, thus limiting the AVC action aerial too long. Cut down its effective length so as to reduce the signal input on powerful stations, by means of a switching arrangement

RCA R-78

Inoperative (tubes light up, but no plate voltage on 56 driver tubes)	1)	check for an "open" 1,100-ohm cathode bias resistor which connects from the cathodes of these tubes to chassis
Inoperative	1)	faulty detector filter choke (located in square can fastened to side of chassis). Replace with an old 5,000-ohm audio transformer, connecting the primary and secondary windings in series aiding. The secondary may be used alone if it gives satisfactory results
Intermittent reception, Whistling or squealing, Motorboating sound	1)	clean and adjust all rotor wiper contacts on tuning condensers
Weak reception	1)	remove chassis and connect terminals of the 400-ohm section of volume control to chassis. This is the round section of the double unit. This will improve sensitivity but may bring in more noise between stations (which can be prevented by properly tuning the receiver)
Fading, Sharp drop in volume, Weak reception, Station hiss	1)	"open" 0.1-mfd. r-f, first-detector and i-f secondary-return by-pass condensers
Fading, (dial settings incorrect)	1)	snapped tabs on oscillator series condenser
Poor control of volume, Distortion, Distortion at resonance	1)	"leaky" 0.1mfd. r-f, first detector and i-f secondary-return by-pass condensers
Whistling or squealing	1) 2)	open-circuiting by-pass condenser. Locate defective unit by bridging a good condenser across the various suspicious condensers in turn clean and adjust all wipers on gang condenser

(Cont'd)

RCA R-78—*(Cont'd)*

Noisy tuning, Whistling or squealing, Motorboating sound between stations	1)	corroded condenser-gang rotor contacts. Solder pigtails between rotors and condenser frame
Sudden change of tone	1)	clean tone control resistance element with alcohol
Noisy volume control, Noisy reception	1)	clean volume control resistance element with alcohol
Loud "hiss" with tone control in "high" position	1)	replace 10,000-ohm resistor (*R-25*) in series with 0.005-mfd. condenser (*C-35*) in plate circuit of 46 output tube
Excessive hum and noise at low volume levels	1) 2) 3)	poor ground connection (or none at all) to *yellow* lead check the 56 tubes (by replacement tests) twist the volume control leads well
Hum at all levels	1) 2) 3)	twist the volume control leads well check the 56 tubes (by replacement tests), faulty tubes, or unbalanced 56 tubes in the driver stage will result in hum remove dial-light wires from vicinity of r-f choke on top of chassis. Twist these wires well, and solder back in place
Hum when stations are tuned in	1)	cathode short-circuits in the types '56 and '58 tubes, caused by high voltage surges on fluctuating line voltages. Install voltage-regulator resistors to prevent wide voltage variations
Mechanical hum	1)	loose laminations in filter choke. Heat in oven until wax melts—allow to harden thoroughly before re-installing in set

RCA R-78 (2) or R-78 (A)

See also Case Histories listed for RCA R-78 receiver

Hum	1)	if due to pickup by antenna from 82 rectifier, connect a well-insulated r-f choke in series with each 82 plate

RCA RAE-79

Cannot be switched on	1)	copper contacts on relay burned away
Cannot be switched off	1)	copper contacts on relay welded to armature of relay
Phono-radio change-over switch inoperative	1)	open-circuited 17-ohm pilot indicator shunt resistor
Remote control does not respond	1)	break in remote control cable at control box
Bottom record dislodged	1)	magazine roller incorrectly adjusted
Record not deposited upon turntable	1) 2)	adjust record transfer lever increase tension of spring in turntable spindle nose
Pickup lowers on outer smooth rim of record, failing to slip into first groove or slides across several grooves	1)	too much tension on flat spring pressing against the tone-arm locating lever. Bend the flat spring out in order to decrease the tension

(Cont'd over)

RCA RAE-79—*(Cont'd)*

Continuous rejecting	1)	riveted joint on which four finger lever is mounted working loose, causing the long finger to dislodge, so that it swings into position against the flat side of the clutch pawl, starting another cycle. Hammer down the rivet, so as to tighten lever, but not so that it will stick
	2)	insufficient tension of four-finger lever spring
	3)	long arm of four-finger lever bent out of shape
Continuous tripping, Cannot be stopped by pressing "off" button	1)	incorrect timing
	2)	improper adjustment of switch actuated by the bracket at the rear of the slide. The contacts of this switch should open and close only when the mechanism has tripped. Adjust switch by loosening the two mounting screws, one of which slides in a slotted adjusting hole
Intermittent phono operation	1)	corroded contact segments of phono-radio transfer switch
	2)	corroded copper center contact of phono volume control
Weak record reproduction, Weak "home" and "radio" recording	1)	dismantle phono pick-up unit, being sure to place a "keeper" across the magnet *before* removing it and noting its polarity with relation to the pole-pieces. Carefully clean all wax from the armature pole-pieces and the rubber dampers. In some instances it is necessary to replace the rubber dampers with new, live rubber After all parts have been cleaned and the rubber dampers installed, the pickup should be re-assembled, the magnet re-magnetized, if possible. The armature should be adjusted so that it is equidistant between the pole-pieces. This adjustment must be made with the permanent magnet in place, although the latter may be turned down in order to gain access to the adjusting screws. Do not remove *the keeper bar* until *after* the magnet has been returned to its position across the pole-pieces
Noisy reception	1)	high-resistance connection at wiping contact between movable arm of volume control, and lug at the center of the cover. Solder a flexible pigtail between these two points

RCA K-80

See also Case Histories listed for RCA K-60 receiver

Inoperative	1)	check for "broken" grounding lead from broadcast band oscillator coil to coil mounting foot
Whistling or squealing	1)	replace screen-to-ground by-pass condenser for 6SA7 with a 0.25-mfd. unit
	2)	reverse the loop antenna plugs located on the sides of the chassis
Hum modulation, Howling	1)	rubber-mount the loudspeaker by means of rubber grommets
	2)	make the loop antenna more rigid by taping winding together at six places (two places on each side, one at top and one at bottom), using Scotch Tape
Rattling on loud "bass"	1)	inspect loop antenna for loose mounting. Fasten securely

RCA Radiola 80

Inoperative (no plate voltage on 1st detector)	1)	faulty plate-supply resistor shunting primary of first i-f coil

(Cont'd)

RCA Radiola 80—*(Cont'd)*

Inoperative below 600 kc	1)	snapped tabs on oscillator series condenser
Inoperative	1)	faulty first i-f transformer. Check windings and connections
Weak reception from 900 to 550 kc	1)	replace the 600 kc oscillator trimmer
Weak reception, Poor tone	1)	check black 715-ohm enameled bias resistor for the 45's under chassis. Possible a poorly soldered joint will be found there. Also check the by-pass condenser across it
	2)	i-f transformer primaries increasing in resistance from 39 ohms to over 400 ohms or higher. Replace transformers
	3)	faulty i-f transformer—especially the first i-f
	4)	decrease in value of 14,300- and 8,000-ohm screen circuit resistors. Replace with wire-wound units
	5)	remove shield from first i-f transformer and bend the copper shield between the coils a little. Realign
	6)	look for "grounding" of strip resistors under chassis. Heat expands them
Intermittent reception, Fading, Distortion, Poor tone at high volume (sounds like defective speaker cone)	1)	open-circuited push-pull input transformer primary. Replace with new unit or repair by replacing with an ordinary 3 to 1 a-f transformer, forming a center-tap on the secondary by connecting two 7,500-ohm resistors from either terminal, with their joining point forming the center tap
	2)	faulty i-f transformer primary—(usually the second i-f)
	3)	faulty 0.1-mfd. condenser in AVC grid circuit by-passing the 1-meg. resistor. It has a *blue* lead from the power pack in which the condenser is located connecting to the 1-meg. resistor. Check both 1-meg. units in the AVC system. Also check the 0.1-mfd. grid-by-pass condenser
	4)	clean out metal flakes from between variable condenser plates by disconnecting leads and flashing with 300 to 400 volts d.c.
Fading and intermittent reception	1)	if this is accompanied by shifting of the station dial settings, check for a break at the spring tab of the low-freq. padding condenser. Replace with a 745-mmfd. unit
	2)	internal "short" in one of the a-f transf. windings
	3)	faulty 0.5-mfd. coupling condenser between the r-f and first detector stages
	4)	check 0.5-mfd. screen grid by-pass cond.
	5)	snapped tabs on oscillator series condenser
	6)	check primary of i-f transformers — especially of 2nd i-f unit
Noisy reception	1)	loose connection in local-distance switch
	2)	faulty '24-A tube
Noisy reception (tubes and voltages test O.K.)	1)	electrolysis in the i-f transformers. Test by touching the grid caps of the first detector and all the i-f tubes, working toward the right. The stage at which the noise decreases considerably is at the right of the defective unit
	2)	poor connection of electrostatic shield from power transformer to chassis. The lead to this shield (which consists of an extra layer of winding between the primary and secondaries) should be scraped free from tar and grounded to the transformer frame and the receiver chassis

(Cont'd)

RCA Radiola 80—*(Cont'd)*

Noisy (even when oscillator tube is removed)	1)	check for "noisy" i-f transformers. Test by touching the grid caps of the first detector and all the i-f tubes, working toward the right. The stage at which the noise decreases considerably is at the right of the defective unit
Noisy reception (stops when first detector or i-f tube is removed)	1)	partially open-circuited primary in one of the i-f transformers. Replace with new unit
	2)	defective push-pull input transformer. Replace with new unit
Distorted reproduction, Hum	1)	open-circuited 60,000-ohm resistor in push-pull input transformer secondary return circuit
Distortion, Low volume	1)	"open" audio transformer primary
	2)	increase in value of 10,000-ohm "C" bias resistor connected between the cathode of the second detector tube and the ground. Replace with a 7,500 to 10,000-ohm resistance
	3)	drop in value of 110,000-ohm unit on resistor strip (connected from i-f plate to second detector cathode). Replace with 5-watt unit
Distortion, No control of volume, Poor control of volume	1)	replace the type '24A tubes in the first r-f stage
	2)	replace the type '35 tubes in the first i-f stage
	3)	remove the 6,000-ohm resistor shunted across the volume control
	4)	"open" 18,000-ohm resistor in screen-grid circuit of first r-f stage. Check the 14,300 and 110,000-ohm resistors in same circuit before installing replacement, as new unit will burn out again if these have dropped materially in value
Continual rasping in speaker	1)	600 kc trimmer loosened by chassis vibration

RCA RE-80

Broad tuning	1)	this set is not equipped with trimmer condensers. However, if you will remove the shields over the tuning condensers you will be able to obtain better alignment by bending the plate provided for that purpose. It will also help to either shorten the length of the antenna or to place a fixed series condenser, having a value of 0.0005-mfd. in the antenna circuit. Slightly throwing the last r-f stage out of neutralization will help. A change over to power detection and use of 56 type tube will likewise prove beneficial
Whistling or squealing, No AVC action, Loud volume, Motorboating sound, Distortion	1)	pilot-lamp socket short-circuiting to the chassis. Since this is connected across the power amplifier filament lines, the power amplifier bias resistor is short-circuited and the cathode voltage from the type '55 tube is removed, thus preventing AVC action. Wrap a layer of tape around the socket lugs to prevent further short-circuiting

RCA T-80

Push buttons stick	1)	loosen dial pointer cable slightly
	2)	lubricate dial pointer tracks sparingly

RCA RE-81

Intermittent radio or phono reception	1)	corroded contact segments at master change-over switch
Intermittent reception, Inoperative	1)	open-circuiting or open-circuited 0.1-mfd. audio coupling-condenser
Weak reception	1)	i-f transf. primary resistance raising from 39 ohms to 400 ohms and over. Replace any such i-f transformers
Fading, Sharp drop in volume, Weak reception, Station hiss	1)	open-circuited 0.05-mfd. r-f, first detector and i-f secondary-return by-pass condensers
Poor control of volume, Distortion, Distortion at resonance	1)	leaky 0.05-mfd. r-f, first detector and i-f secondary-return by-pass condensers
Noisy tuning, Whistling or squealing, Motorboating sound between stations	1)	corroded condenser-gang rotor contacts. Solder pigtail lead from rotor shaft to chassis
Motorboating sound	1)	clean condenser wipers. Install 0.1-mfd. condensers between junction of resistors *R-14* and *R-15*. Connect a 10-mfd. 50-volt electrolytic condenser from *green* lead on volume control to ground. (*Positive* foil of this condenser goes to "ground")
Inoperative home recording meter	1)	remove meter and decrease tension upon pivot of meter needle
Weak record reproduction, Weak "home" and "radio" recording	1)	see Case History for this same Trouble Symptom listed for RCA RAE-79 receiver

RCA Radiola 82, R-82

Weak reception	1)	resistance of i-f transformer primaries raised from 39 ohms to 400 ohms and higher. Replace any such transformers
"Noisy"—sounding like bad static (even when oscillator tube is removed)	1)	check for noisy i-f transformer

RCA 84BT

"Blocking" of reception	1)	try new IF4 tube. Also check battery switch contact for wear, and replace switch if necesssary
	2)	check "B" batteries

RCA RAE-84

Intermittent reception, Erratic, Whistling or squealing, Motorboating sound	1)	clean and adjust all rotor wiping contacts on tuning condensers

(Cont'd over)

RCA RAE-84—*(Cont'd)*

Fading, Sharp drop in volume, Weak reception, Station hiss	1)	open-circuited 0.1-mfd. r-f, first detector and i-f secondary-return by-pass condensers
Fading, Dial settings incorrect	1)	snapped tabs on oscillator series condenser
Poor control of volume, **Distortion,** Distortion at resonance	1)	leaky 0.1-mfd. r-f, detector and i-f secondary-return by-pass condensers
Noisy tuning, Whistling or squealing, Motorboating sound between stations	1)	corroded condenser-gang rotor contacts. Solder pigtail from rotor shaft to chassis
Mechanical hum	1)	loose laminations of filter choke—heat in oven
Noisy reception	1)	noisy volume control
Phono troubles	1)	see Case Histories listed for RCA-Victor RAE-79
Manual lever jammed	1)	manual lever bent

RCA BP-85

Same Case Histories as those listed for RCA BP-55 receiver

RCA 85BT

Weak reception	1)	check antenna coil condenser *C-4* (located on antenna coil under chassis). Replace with a 0.002-mfd. mica condenser)
	2)	realign first i-f stage. If no improvement is noticed, check condensers *C-19* and *C-32*

RCA 85T

Weak reception (voltages O.K.)	1)	"shorted" turns in antenna coil
Weak reception (plate voltage low)	1)	check 33 and 330-ohm bias resistors (connected in series with negative-return circuit of rectifier)

RCA 85T-1

Inoperative, or weak reception on short-waves	1)	faulty 33,000-ohm resistor connected from 6A7 suppressor to ground
Weak reception (all bands)	1)	increase in resistance of 6.8-megohm resistor *R-13* in grid circuit of first detector
Difficulty in getting receiver to "track" correctly during alignment	1)	replace 450-mmfd. condenser *C-1* (connected in oscillator grid circuit) with a 470-mmfd. unit

RCA 86K

Interference in the form of heterodyne "beats," image response, etc.	1)	close link on antenna terminal board so it connects with the "A" terminal

RCA Radiola 86

See also Case Histories listed for RCA Radiola 80 and RCA Radiola 82 receivers

Poor recording	1)	try reversing the *black* and *black-with-red* tracer leads on the two terminals in back of the amplifier. The output is "shorted" if they are connected incorrectly

RCA 86T, 86T1

Weak reception	1)	connect a 0.0001-mfd. (or slightly larger) condenser from the antenna terminal to the stator of the oscillator tuning condenser
Interference in the form of heterodyne "beats," image response, etc.	1)	close link on antenna terminal board so it connects with the "A" terminal

RCA 87K

Interference in the form of heterodyne "beats," image response, etc.	1)	close link on antenna terminal board so it connects with the "A" terminal

RCA 87K-1

Fading in and out	1)	check tone compensation condenser

RCA 87EY, 87X, 87Y

Weak reception	1)	the i-f circuits of these instruments are aligned in the factory to produce a good balance between sensitivity and tone quality. In localities where sensitivity is of greater importance than tone, an increase can be obtained by realigning the i-f stages, using the output meter method. A battery operated test oscillator should be used as the source of signal, with its output connected thru a capacitor to the 6A8 grid, and its ground lead attached to the "G" terminal of the receiver input. The usual output meter or indicator must be connected either across the speaker voice coil or output transformer primary. It is preferable, if convenient, to use a 1/1 isolation transformer in the AC power circuit. Each i-f trimmer should then be adjusted to produce maximum "peak" output.

RCA 88K

Inoperative (low, or no plate voltage on 6K7 r-f tube)	1)	"shorted" on "leaky" 0.0047-mfd. condenser *C-6*. Also check 1,000-ohm resistor *R-2* in series with r-f tube plate supply circuit for possible damage

RCA R-89

"Blocking" or "choking" distortion at high-volume	1)	reduce value of 10-megohm resistor *R-9* in 6F5 grid-return circuit to approximately 1-megohm by connecting a 1-megohm resistor across it
Circuit changes for improved receiver performance in Early-run receivers	1)	change condenser *C-5* from 0.025-mfd. to 0.015-mfd.
	2)	connect a 330,000-ohm resistor (*R-10*) across pickup output jack

RCA R-90

Inoperative (no voltage from 2nd det. plate to cathode)	1)	check condensers *C-24, C-25, C-26, C-28, C-29*

(Cont'd)

RCA R-90—*(Cont'd)*

Inoperative (plates of rectifier tube red hot)	1)	"shorted" condenser *C-36*
Inoperative, Weak reception, Poor tone quality, Poor AVC action	1)	r-f amplifier out of alignment
	2)	oscillator not tracking at the proper frequency
Weak signals, Fading, Broad tuning, Indistinct tuning-light operation,	1)	follow manufacturer's instructions for adjusting the i-f circuits of the receiver to *exactly* the frequency at which the untuned transformer is "peaked" (around 175 kc)—i.e., so the AVC circuit and the signal circuit are in synchronism
	2)	"open" AVC coupling condenser and grid resistor within first i-f transformer shield
	3)	resolder all joints on antenna coil
Tuning light inoperative, but radio reception normal	1)	try slight changes in resistance values of resistors *R-29* or *R-30*
Whistling or squealing	1)	check screen grid condenser *C-4*

RCA R-90P

Inoperative (no voltage from '55 1st audio plate to cathode)	1)	check condensers *C-39, C-40*
Inoperative (no voltage from '55 1st audio plate to ground)	1)	check condensers *C-38* and *R-23*
Weak signals, Fading, Broad tuning, Indistinct tuning light operation	1)	follow the manufacturer's instructions for adjusting the i-f circuits of the receiver to *exactly* the frequency at which the untuned transformer is peaked (around 175 kc)—i.e., so the AVC circuit and the signal circuit are in synchronism
Weak or intermittent signals and inefficient oscillator action on 49-meter band	1)	short out the 20,000-ohm resistor *R-7*. Clean, adjust, or replace the wave-change switch. Clean dust out of gang condenser. Tighten the condenser stator mounting screws. Solder a jumper between the oscillator stator and its connecting lug. This can be done by very carefully soldering a wire to the ends of all the stator plates at the stator plate bridge and adjacent to the stator terminal lug. Care must be exercised by using cotton batting or some other similar substance to prevent the solder, or paste getting in between the condenser plates
Low-frequency (i-f) oscillation (causing choppy effect on some weak signals—sounding very much like "hum modulation")	1)	connect a 0.25-mfd. condenser from grid return of 1st i-f transformer secondary to the cathode of i-f amplifier tube
Hum pickup	1)	reduce value of resistor *R-20* from 1,500 ohms to 1,200 ohms (in early production receivers). This lowers the pulsating currents flowing in the windings of the saturated-core transformer

RCA R-91

"Rumble" on phono reproduction	1)	reverse one of coils of stator assembly of phono motor by removing one coil from the stator (without disconnecting it), turning it end-for-end, and replacing it on the stator so its leads are toward the center bearing

RCA R-93, R-93B, R-93C (Record Players)

Excessive vibration either at starting or running	1)	insufficient lubrication in outer bearing, or anything else that will cause stator to "bind"
	2)	metal washer at bottom of main bearing not in proper place. It should be below leather washer
	3)	leather washer not oiled. When replacing leather washer, make sure it is thoroughly soaked in oil
	4)	motor not properly supported from motor board. This will cause excessive vibration
	5)	burrs on salient poles of rotor or stator. Remove with fine emery cloth. Clean
Hum	1)	do not place record player on top of radio cabinet since acoustic feedback may tend to greatly accentuate any mechanical hum
Removing rotor from stator	1)	the rotor and turntable assembly simply rests on the ball bearing at the bottom of the vertical bearing, and may be removed by lifting out. (Do not turn player upside down without holding turntable.)
Lubrication	1)	both the rotor and stator have bearing surfaces about the center vertical axis. These bearings and the ball bearing at the bottom of the turntable's shaft should be oiled whenever player is serviced. The leather washer beneath the stator is to be pliable and soaked in light oil

RCA 94BK2

Inoperative on push-buttons, O.K. on manual tuning	1)	"open" push-button section in antenna transformer

RCA 94 BP1

Circuit modifications for improved performance	1)	circuit modifications as explained below have been effected on the 1st-production (RC-407) Model 94BPI Series, battery-operated portable receivers. These changes are incorporated on the bulk of production. Wherever it is necessary to service an instrument not having the revised circuit, it is recommended that the following changes be made (a) Change 820-ohm bias resistor of 1C5G stage to 390 ohms (b) Change plate coupling capacitor from 0.0025 to 400-mmfd. (c) Change 1H5G plate by-pass from 250-mmfd. to 100-mmfd. (d) Change 300-mmfd. of 2nd i-f secondary by-pass to 100-mmfd. (e) Change 0.0025-mfd. of volume control arm circuit to 400-mmfd. (f) Change 1C5G plate by-pass from 0.01-mfd. to 0.001-mfd. (g) Add 33,000 ohm resistor in series with "high" end of volume control (h) By-pass "high" end of volume control to chassis with 100-mmfd. (i) Change oscillator grid resistor from 220,000 ohms to 150,000 ohms

RCA 94BP4

Audio oscillation or howl	1)	keep *green* lead from No. 8 pin of 1C5-G socket (to volume control) as far away as possible from *blue* lead connected to same socket. Also dress the *green* lead from tuning condenser to loop antenna so it lays between the 1H5G and 1C5G tubes

RCA R-94B

Low-frequency rumble	1)	check the tone arm mounting to see if mounting nut is screwed up too tightly. If so, loosen it about 1 complete turn

RCA 94X, 94X1, 94X2

Improving receiver performance	1)	whenever replacement of condenser *No. 30873* is necessary in early-run receiver, replace it with two 16-mfd. sections instead of a 16-mfd. and a 5-mfd.
Instability	1)	change 25L6G plate by-pass condenser *C-11* (marked *7250-569*) so as to connect it from the 25L6G plate to 25L6G heater (*H*) lug adjacent to cathode (*K*). On the 94X receiver only, also change 6J7 screen by-pass condenser *C-8* (marked *72050-503*) so as to connect between 6J7 screen (*SG*) and the 6J7 heater (*H*) lug adjacent to cathode (*K*). Dress lead from 25L6G plate to output transformer away from 6J7 tube
Hum	1)	make the following circuit changes: (a) cut off *blue* lead from dry electrolytic condenser and disconnect it from the 6J7 cathode terminal (b) install a 0.25-mfd. paper condenser (Stock *No. 30965*) from 6J7 cathode terminal to chassis ground
	2)	reverse voice coil leads
Whistling or squealing when tuned to a station	1)	lead from 25L6G plate to the output transformer should be dressed away from the 6J7 socket, preferably along the rear side of the chassis
Speaker rattle	1)	cone strikes electrolytic condenser near it. Bend condenser clamp to provide clearance

RCA 95T, 95T1

Chassis, loudspeaker, circuit and all miscellaneous components of the receiver are similar to those of Model 95T. Published service diagram and notes for the 95T are therefore applicable to the 95T1. No separate service notes or diagram have been prepared by the set manufacturer for the 95T1.

Microphonic howl at high volume	1)	*blue* lead which runs from 6A8 oscillator plate terminal to oscillator coil should be cut as short as possible and kept separated from the chassis, tuning condenser, and other leads
To accentuate the lower audio frequency range	1)	increase 0.015-mfd. condenser *C-15* to 0.025-mfd. (Stock *No. 4870*)

RCA 95T5

To increase sensitivity of receiver	1)	align tuning condenser at 600 kc, and realign the trimmer at 1,500 kc as follows: (a) Check alignment of antenna coil with "Tuning Wand" at 600 kc. If *brass* end gives increase in signal,

(Cont'd)

RCA 95T5—*(Cont'd)*

To increase sensitivity of receiver —*(Cont'd)*		bend rotor plates of *antenna* section of tuning condenser outward to produce maximum peak output. If *magnetite* end gives increase in signal, bend plates of *oscillator* section of tuning condenser to obtain maximum output. (b) Re-align 1500 kc antenna and oscillator trimmers in the usual manner

RCA 95X6

Distortion when large antenna is used	1)	reverse power line plug
	2)	shunt two 1-mfd. condensers (in series with each other) across power line, and connect their common junction to ground

RCA 96E

See also Case History listed for RCA 95T5 receiver

Motorboating sound	1)	"open" 0.1-mfd. condenser connected from bottom of antenna coil secondary to ground
	2)	"open" second filter condenser

RCA 96K

Intermittent reception	1)	"short" between socket prongs under push-button assembly
Distortion	1)	replace 390-ohm resistor *No. 12*

RCA 96K6

Motorboating sound, Oscillation	1)	check audio coupling condenser. Use a 0.00025-mfd. replacement unit

RCA 96T, 96T1

Same Case Histories as those listed for RCA 95T5 and RCA 96E receiver

RCA 96T2

Same Case Histories as those listed for RCA 96K receiver

RCA 96T4, 96T5, 96T6

Whistling, squealing, "blocking," or general instability	1)	it is possible that these troubles result from use of a very short length of wire antenna, causing this circuit to resonate in the i-f range. This may be avoided by increasing length of the antenna, or adding a 100-mmfd. capacitor directly across the antenna-ground input terminals. In the event that these operations fail to effect a remedy: (a) See that the 0.1-mfd. capacitor *C-37* mounted under i-f transformer is kept well away from oscillator coils by dressing same close to rear corner of chassis over the i-f leads (b) Dress the diode bus lead running from "B" of 2nd i-f transformer to 6SQ7 socket toward chassis away from oscillator coils. Dress 270-mmfd. molded capacitor *C-14* over the bus lead (c) Add a 0.25-mfd. 200-volt capacitor in parallel with the high-capacity electrolytic filter section
Push-button antenna trimmers inoperative	1)	"short" to rivet between back-to-back band switch terminals

RCA 96T7

Intermittent noise	1)	check output tube cathode by-pass condenser

RCA 97K

Inoperative on dial tuning, Intermittent reception	1)	check for intermittently "open" 4700-mmfd. tubular condenser *C-27* connected in series with oscillator section of tuning condenser
Low-pitched squeal or howl when phono push-button is depressed	1)	see if gummed tape holding speaker leads against underside of chassis has torn loose. Dress leads away from phono jack, and fasten properly with the tape

RCA 97T2

Crackling noises	1)	replace 390-ohm 6F6 power stage cathode resistor

RCA TMV-97, TMV-97B (Test Oscillators)

Inoperative	1)	"open" primary winding in modulation transformer. (This may be due to electrolysis caused by the difference in potential existing between the primary winding and the core.) When replacing the transformer, it is best to remove the difference in potential between the core and the primary winding by insulating the core and the mounting strap from the chassis by using suitable fibre washers, and by wiring a jumper wire from the mounting strap "B+" so that the core is at the same potential as the primary winding, thereby eliminating a source of electrolysis. It is worthwhile to take this precaution even before the instrument goes dead

RCA TMV-97C (Test Oscillator)

Precaution for preventing run-down B-battery	1)	when using this oscillator, be sure shielded lead from output connection is fabric-covered, for B-battery will run down if shielding touches output jack

RCA 97Y, 98EY

Hum, Audio whistling or howling	1)	locate shield of cable which interconnects 6J7 grid to the volume control. Change it from the tone control terminal to terminal No. 3 (one nearest end of chassis) of the volume control

RCA 98K

Intermittent reception, Fading	1)	in some chassis the temperature compensating condenser *C-28* associated with "A" band oscillator circuit is dressed too close to the corner of lug. This source should be checked where trouble of such sort is evidenced; and the capacitor dressed safely away from the lug. It will be advisable to effect the same operation on any chassis being serviced for other reasons as a preventive measure
	2)	intermittently "open" 0.05-mfd. avc filter condenser *C-9*
Line noises when tuned automatically	1)	connect a 0.01-mfd. 600-volt condenser from extreme right-hand terminal of tuning switch to chassis
Dial drive cord slips, Irregular dial action	1)	fasten a spring (Stock *No. 31418*) to end of the cord which is normally fixed solid to the drum, and anchor its other end to the same lug occupied by the other No. 31418 spring

RCA R-98

Hum at maximum volume	1)	dress pilot lamp lead to rear of chassis —well away from the audio circuits
Phono motor speed drifts at slow rate, or shifts erratically to another speed	1)	generally caused by (a) binding of rotor or spindle bearings due to lack of lubrication, (b) scored shafts or bearings. (c) binding due to tight adjustment of thrust bearing "B", (d) binding of turntable spindle bearing on motor board (where used), (e) improper centering of motor with respect to turntable spindle
Governor "chatter" and noise in phono motor	1)	when the governor rattles or flutters rapidly, accompanied by excessive mechanical noise, the likely source of trouble is (a) glazed felt friction pad due to lack of lubrication, (b) rotor not centrally positioned in stator, (c) thrust bearing "A" worn, (d) mis-aligned or rough governor disc

RCA 98T

Motorboating sound	1)	dress filter condenser leads away from antenna coil

RCA 98X, 98YG

Same Case Histories as those listed for RCA 97Y receiver

RCA 99K

See also Case Histories listed for RCA 98K receiver

Fading	1)	"open" 0.01-mfd. condenser which couples antenna coil to 6A8 control grid

RCA R-99

Distortion	1)	"leaky" 0.05-mfd. coupling condenser *C-9* connected between 6L7 and 6C5 tubes

RCA 99T

Same Case Histories as those listed for RCA 98K receiver

RCA-100

Inoperative (appreciable background noise)	1)	check condenser *C-9* across oscillator plate supply
Weak reception, Distortion	1)	"shorted" 0.25-mfd. condenser *C-18*
	2)	"leaky" antenna coupling condenser. This will block the AVC action. Replace with similar higher-voltage unit
Modulation hum	1)	try reversing the line plug in its socket
	2)	connect a 0.1-mfd. 400-volt by-pass condenser from one side of the power transformer primary to ground
	3)	connect a 500-ohm resistor from the "set" side of the 0.01-mfd. antenna condenser to chassis. (Late models already have this resistor)

RCA 100B Speaker

Burned out coil	1)	rewind bobbin full of No. 26 d.c.c. copper wire. Then use a dynamic speaker output transformer with low-impedance secondary. This will improve the tone and the volume

RCA 101

Inoperative (appreciable background noise)	1)	check condenser *C-9* across oscillator plate supply
Weak reception, Distortion	1)	"shorted" 0.25-mfd. condenser *C-18*

RCA M-101 Auto Radio

Inoperative (no plate voltages)	1)	faulty synchronous vibrator
	2)	loose socket contacts
	3)	"shorted" condenser block
Howling at high volume	1)	"open" condenser bank
Hum	1)	replace volume control
Noisy	1)	replace leads from condenser gang stators to grid caps on tubes
	2)	inspect for break in lead-in shield where it connects to receiver

RCA-Victor 102

Line cord burned out	1)	when replacing with new cord, roll a piece of mica over the resistance asbestos, and tape in place, allowing the mica to be about ½-inch larger than the resistance wire. This wire gets cut into by the '37 tube socket lug. The mica is to go into the set under the socket. Tie the line cord, so it always stays fastened to the chassis

RCA R-103-S Record Player

To change audio output characteristics of record player	1)	220,000-ohm resistor *R-1* shunted across pickup cartridge controls the low-frequency response; increase value of *R-1* if increased "lows" are desired. For maximum low-frequency response, remove *R-1* altogether Resistor *R-2* (1-megohm connected in series with volume control and in parallel with 82-mmfd. condenser *C-1*) controls pickup output; smaller values of *R-2* give increased output. Condenser *C-1* controls high-frequency response; to increase highs, increase value of *C-1*
	2)	where a decrease in high-frequency response is desired (for reducing "needle scratch" on worn records, etc.) change the circuit. Connect the crystal cartridge, a 22,000-ohm resistor (*R-3*) and the volume control all in series with each other to form a closed circuit. Connect a 2700-mmfd. condenser (*C-2*) directly across the volume control in this circuit. In this arrangement, *C-2* acts as a load in the pickup and also controls the high-frequency response. Smaller values of *C-2* give more pickup output and also more "highs". Increasing *R-3* decreases the "highs"

RCA U-103

Phono motor speed drifts at slow rate, or shifts erratically to another speed	1)	see remedy for this Trouble Symptom listed under RCA R-98 receiver
Governor "chatter" and noise in phono motor	1)	see remedy for this Trouble Symptom listed under RCA R-98 receiver

RCA M-104 Auto Radio

Noisy	1)	replace all leads from stators of condenser gang to grid caps
Tube hiss on weak signals	1)	locate the switch which is used to cut in and out a series audio coupling condenser between the 6B7 plate and the '41 control grid. Disconnect the two wires going to it; solder them together and tape them. Now connect a wire from the control grid cap connector of the 6B7 to one terminal of the switch. To the other switch terminal, connect one side of a 0.0015-mfd. mica condenser. Ground the other side of this condenser to the receiver case. The switch will now serve as a two-point tone control for reducing tube bias on weak signals
Motor noise	1)	inspect for break in lead-in shield where it connects to receiver
Whistling or squealing	1)	replace dual 0.05-mfd. grid-return condensers *C-1* and *C-5*

RCA K-105

Inoperative	1)	check for "open" voltage dividers
Inoperative on "B" band		see that oscill. trimmer cond. for this band does *not* touch paper casing of 16-mfd. electrolytic 6SA7 screen circuit condenser *C-41*
Oscillation, and station drift	1)	intermittent "open" in avc line by-pass condenser
High frequency mechanical buzz	1)	inspect to see if "diffuser" mounted across front of the loudspeaker is striking the cone or the cabinet baffle. If so, remove diffuser entirely. It is not used on later production receivers
Hum (tunable)	1)	check for broken lead to A and B primary loop

RCA U-105

Same Case Histories as those listed for RCA U-103 receiver

RCA-Victor U-106

Noise in loudspeaker when changing needles, "Wow" in record reproduction	1)	clean the "shorting contact"
	2)	warm up the entire instrument to about 60 degrees Fahrenheit. The ejector tip should be centered and free to rotate. There should be no solid particles on the gear teeth or in the grease; no tendency to bind. The turntable plate should be in dynamic balance and the spindle should be absolutely straight. Proper lubrication is important
Low frequency "boom"	1)	some instruments are compensated to give an abundance of low-frequencies. Later production, however, has a modified circuit which lessens the response below 100 cycles. Should there be customer reaction to the preponderant low-frequency response, the following circuit components should be checked and revised to the latest specifications per the following: (a) Replace the 820,000-ohm resistor *R-24* with one of 1.2 megohms (b) Replace the 0.01-mfd. capacitor *C-54* with a 3,600-mmfd. unit (c) Replace the 150-mmfd. capacitor *C-45* with a 470-mmfd. unit (Stock *Nos. 30208, 12811,* and *30433* are the respective parts required)

(Cont'd)

RCA-Victor U-106—*(Cont'd)*

Lubrication	1)	clean motor gear-box thoroughly before regreasing. Apply less than a tablespoonful of a grease, such as "Cities Service No. 7035-A1" or "Koolmotor Universal Trojan No. 1," directly on gears, taking care to get none in rotor bearings. Put medium oil (S.A.E. No. 30) in the oil holes. Cover main gear and cam of automatic mechanism with a light grease such as "Socony-Vacuum No. 2." Any good household oil, such as "3-IN-ONE" is suitable for the ejector-tip bearing
Important lead "dress"	1)	filament leads should be dressed away from audio grids
	2)	output plate leads should be dressed away from radio-phono switch
	3)	maintain original size, length and position of: (*a*) all leads from range switch to antenna and oscillator coils. They should be short, rigid and separated as far as possible from other leads and chassis (*b*) lead from oscillator coil to ground

RCA U-107

Phono "rumble" or low-frequency vibration	1)	reduce low-frequency reproduction by spacing loud-speaker baffle board about ½ inch away from cabinet by means of spacers

RCA M-108 Auto Radio

Noisy	1)	replace leads from stators of condenser gang to grid caps of tubes

RCA M-109 Auto Radio

Inoperative (from 550 to 750 kc), Weak reception (from 900 kc to 1500 kc)	1)	"open" 100-ohm resistor in the Antenna Filter circuit. (This resistor, along with a choke and condenser, are contained in a small metal can located at a point where the antenna enters the chassis.) Remove can and replace resistor

RCA U-109

Thin, lifeless phono reproduction	1)	pickup voltage too low—should be adjusted. With Victor record No. 8419-A being played at 400 cycles set control to give 5 volts across speaker voice coil

RCA 110

Volume changes intermittently between a high and low level (distortion while at low level)	1)	intermittent "open" in the coupling condenser between the 57 second detector and the 2A5 output tube
Volume decreases a short time after set is turned on	1)	replace 27 AVC tube (center rear of chassis) with a 56 tube
Motorboating sound, Whistling or squealing	1)	if whistling or squealing stops when grid cap of 2A7 is touched, replace the dual condenser

(Cont'd)

RCA 110—*(Cont'd)*

Hum (all tubes and filter condensers check O.K.)	1)	connect the receiver to a good ground connection
Tracking condenser C-31 appears to be missing (due apparently to error in production)	1)	try inserting a 15-mmfd. min. and 70-mmfd. max. condenser (one small enough to fit between oscillator coil and chassis). Adjustment to about 50-mmfd. will give maximum deflection at 600 kc while rocking the tuning condenser

RCA 110K

Non-oscillation on a push-button range	1)	check oscillator grid leak to assure that it is 56,000 ohms. Some receivers employed a 33,000-ohm leak which was occasionally found troublesome with low line voltage
No low-frequency coverage on push-button oscillator coils	1)	use a high-inductance coil (Stock *No. 37133*) for the 540-1,030 kc push-button oscillator ranges

RCA 111

Same Case Histories as those listed for RCA 110 receiver

RCA 111K

See also Case Histories listed for RCA 111 receiver.

Avc inoperative ("positive" voltage on avc diode)	1)	check for leakage between windings of second i-f transformer

RCA 115

Volume changes intermittently between a high and low level (distortion while at low level)	1)	intermittent "open" in the coupling condenser between the 57 second detector and the 2A5 output tube

RCA M-116

Weak reception (all voltages O.K.)	1)	check 6B7 control-grid lead for "short" to ground due to screw-on type shield can cutting through insulation of grid lead

RCA-117

Inoperative, No screen voltage on oscillator tube	1)	open-circuited oscillator plate series resistor
	2)	"shorted" oscill. plate by-pass condenser
Intermittent reception, Inoperative, No screen voltages	1)	open-circuiting 10,000-ohm screen drop resistor
Choked, distorted reception, Weak reception	1)	leaky or short-circuited type '6B7 tube cathode by-pass condenser
Whistling or squealing, Weak, choked signals	1)	loss in capacity of oscillator plate by-pass condenser
Fading, Intermittent reception, Station hiss	1)	open-circuiting grid filter condensers in oscillator and i-f stages

(Cont'd over)

RCA-117—*(Cont'd)*

Sputtering noises when set is first turned on (unaffected by volume-control setting)	1)	poor connections where taps are taken off the voltage divider—especially the tap supplying the '6B7 tube. Cut all these wires and solder them to new external wire-wound resistors of 10,000, 6,000 and 5,000 ohms respectively
Slipping dial in "fast" tuning position	1)	insufficient tension of three copper spring clips on dial-drive shaft

RCA-118

Inoperative (no oscillator plate voltage)	1)	"open" 30,000-ohm oscillator plate series carbon resistor. (If this resistor has overheated, also check the 4-mfd. electrolytic condenser which by-passes it. This condenser is one section of the dual block mounted to the left of the waveband switch upon the front of chassis)
Inoperative, Intermittent operation (no screen voltage on all but the 41 output tube)	1)	intermittently "opening" 10,000-ohm screen-grid voltage-dropping resistor. This is a wire-wound unit mounted on the terminal strip located below the power transformer
Weak reception (all voltages, currents, O.K.)	1)	"open" 0.05-mfd. condenser (*C-5*) by-passing the 1st detector grid-return from the AVC to ground
Intermittent operation, Fading	1)	partially "opening" 0.015-mfd. coupling condenser *C-28* which connects from 42 grid to 6B7 plate, and is located under main resistance strip. (In later production, this is a 0.02-mfd. unit). Replace with a 0.02-mfd. 600-volt unit. Align receiver
	2)	"open" 0.05-mfd. 1st detector-oscillator and i-f grid filter condensers
	3)	snapped tabs on oscillator series condenser. Solder if possible—or replace
	4)	"open" 6A7 or 6D7 grid-section by-pass condensers
Whistling or squealing, (signals weak) Motorboating	1)	"open" (or lowered-capacity) 4-mfd. oscillator plate by-pass condenser
Distortion, Choked reproduction.	1)	"shorted" or "leaky" 6B7 cathode 4-mfd. by-pass condenser mounted on terminal strip under power transf.
	2)	tap on volume control grounding to chassis
Intermittent hum	1)	intermittently "opening" 0.05-mfd. condenser coupling 6B7 grid to volume control
Intermittent crackling	1)	if heard only on carrier, check i-f coils and mixer cathode by-pass cond.
Noise	1)	connect a 0.01-mfd. 400-volt condenser from each side of the power line to ground
Station interference	1)	install a wave trap in antenna circuit
Slipping dial (slips when knob is pushed in for fast tuning)	1)	failure of 3 copper spring clips on the dial drive shaft which are not properly engaging the saw-toothed gear of the reduction drive assembly. Bending each of these spring clips in, slightly, to increase their tension and make more positive engagement with the gear possible, will clear up the trouble

RCA-119

Poor selectivity, Broad tuning	1)	faulty tuning condenser assembly, usually causing a high-resistance short between the stator plate assembly and the ground. This is due to the absorption of moisture by the bakelite insulator between the stator and ground

RCA 120

Inoperative (no plate voltage on r-f and i-f plates)	1)	"shorted" filter condenser
	2)	"shorted" plate lead in last i-f transformer (transformer must be removed from chassis to locate the wire)
Intermittent operation, Operates at low volume on strong signals and intermittently comes up to normal volume	1)	replace the three 0.05-mfd. grid filter condensers in the r-f, 1st detector and if circuits
	2)	check all soldered joints on oscillator coil and oscillator circuits, oscillator series condenser, etc.
	3)	"shorted" i-f coil trimmers
	4)	check 0.05-mfd. condenser between center terminal of volume control and control-grid lead of 2B7 second detector
	5)	"shorted" bias resistor for the r-f and i-f tubes. (Resistor is located immediately adjacent to the i-f socket)
High-pitched whistle when tone control is set at "treble"	1)	"open" 0.005-mfd. condenser connected from plate to screen of 2A5
Distortion (all circuits and voltages O.K.)	1)	check 150,000-ohm resistor between *yellow* lead on volume control and "common" screen circuit
Whistling or squealing when volume control is advanced	1)	"open" screen by-pass condenser
Whistling or squealing (stops when cap of 2A7 tube is touched)	1)	replace dual by-pass condenser
Hum	1)	try several other positions for *green* wire coming through hole in chassis and connecting to 2B7 grid
Motorboating sound (no signals)	1)	check for "open" condenser in 3-section electrolytic block located to right of gang condenser. The screen by-pass unit is the most frequent offender. Replace entire block
Motorboating sound when set is tuned to the higher broadcast band frequencies, or on short-waves	1)	connect a 2-mfd. electrolytic condenser (or larger) from 2A5 screen to chassis

RCA 121

See also Case Histories listed for RCA 122 receiver

Inoperative, but appreciable background noise	1)	clean wiping contacts on wave range switch
	2)	check two condensers C-21 and C-22 across oscillator plate supply

(Cont'd)

RCA 121—(*Cont'd*)

Inoperative (no plate voltage on oscillator section of osc.-first det.)	1)	if 30,000-ohm 1-watt resistor *R-36* near oscillator padding condenser is very hot check the 4-mfd. condenser *C-22* in the filter pack for "short"
Inoperative (in either, or both positions of range switch), Range switch operates noisily and critically	1)	the contacts, or one contact, on range switch not functioning properly. The first step is to locate the contact that is not closing properly. To do this, first remove the chassis and place it in operation upside down with the cover removed. If the set is inoperative in one position of the range switch, place the range switch in this position. Then, with a small screw driver having an insulated handle, short-circuit (in turn) each pair of stationary contacts which should be bridged in this position by a moving contact until a pair is found which causes the set to operate normally. This will locate the faulty moving contact The reason this moving contact is not properly touching the two stationary contacts is that one stationary contact has worn a very shallow groove in the moving contact and pulled it to one side of the slot in which it moves, thus producing friction and preventing the phosphor bronze spring from forcing the moving contact into its proper place. The proper adjustment then is merely to bend the end of the stationary contact which has worn a groove in the moving contact until the action of this contact in the groove tends to hold the moving contact in the center of the slot instead of pulling it to one side. It will usually be found that one of the outside stationary contacts requires to be bent upwards or downwards If the trouble with the range switch is not an open circuit at one position, but merely a noisy operating condition, this may be located in the same way as an open circuit. In that case each pair of stationary contacts should be "shorted" in turn with the screw driver until a pair is found which when "shorted" with the screw driver relieves the noisy operating condition.
Inoperative Motorboating sound on certain settings of volume control	1)	"open" 8-mfd. condenser in the 3-section electrolytic condenser block (located in a cardboard container on the top side of the chassis. Replace entire block
Intermittent reception as the tuning dial is rotated, (this is not the case when the set is removed from the cabinet)	1)	short-circuit between the bare wire connecting the stator plates of the gang condenser and the wave-band switch, and another bare wire near it connected to ground. When chassis is inserted in the cabinet, the condenser gang is pressed down on its rubber cushions, as a result of the shaft fitting into the hole, thereby forcing the two wires very closely together and causing them to short-circuit. Separate the wires about twice the distance that they were apart originally
	2)	check 0.05-mfd. condenser between short-wave antenna coil and ground
Weak, distorted reception	1)	"shorted" 0.25-mfd. condenser *C-32*
	2)	"shorted" shielded *red* lead
Poor selectivity	1)	faulty oscillator coil, or poorly soldered connections in oscillator circuit

(*Cont'd*)

RCA-121—(*Cont'd*)

Instability after replacing a filter condenser	1)	long lead on new condenser too near wave-change switch. Re-route this lead
Motorboating sound	1)	"open" third 4-mfd. section in electrolytic filter block
	2)	if placing finger tip on control-grid of rear 58 tube stops it, remove the *red* lead coming from condenser *C-28* in the 3-section electrolytic pack and replace with a single 8-mfd. unit
Motorboating sound and "cutting out"	1)	replace 600-ohm first r-f bias resistor
Whistling or squealing	1)	check double 4-mfd. electrolytic condenser
Hum (on short-wave band)	1)	"open" third 4-mfd. section in this same block. Replace entire block

RCA 122

Inoperative	1)	open-circuited 10,000-ohm screen voltage-dropping resistor
	2)	short-circuited oscillator plate by-pass condenser
	3)	open-circuited oscillator plate series resistor
Inoperative, Whistling or squealing	1)	open-circuited 4-mfd. oscillator plate by-pass condenser
Inoperative, No oscillator plate voltage	1)	burnt-out 30,000-ohm oscillator plate dropping resistor. (Check for shorted 4-mfd. by-pass condenser at same time)
	2)	open-circuiting screen-voltage dropping resistor
Intermittent reception, Fading, Noisy	1)	open-circuiting 0.05-mfd. by-pass condensers employed as grid filters in the r-f, 1st detector-oscill., and i-f secondary return circuits. In some cases an "open" 0.05-mfd. i-f grid filter condenser will cause some motorboating and oscillation at the high frequencies
Stations received at two points about 20 kc apart—with distortion between these two points	1)	"shorted" or "leaky" 0.05-mfd. i-f grid filter condenser
Fading, Oscillator drift	1)	snapping of connecting tabs of oscillator series condenser
	2)	excessive solder at ends of oscillator series condenser contacting metal jacket

RCA U-123

Intermittent reception	1)	intermittently "open" 15,000-ohm screen-dropping resistor
Fading	1)	faulty 15,000-ohm screen resistor. Replace with 10-watt unit

RCA U-124

Phono motor speed "drifts" at slow rate, or shifts erratically to another speed	1)	see remedy for this Trouble Symptom listed under RCA R-98 receiver
Governor "chatter" and noise in phono motor	1)	see remedy for this Trouble Symptom listed under RCA R-98 receiver

RCA 125

Distortion (slight lowering of plate voltage on 6B7 2nd detector)	1)	"leaky" 4-mfd. electrolytic cathode by-pass condenser on the 6B7 2nd detector. (Condenser is located between the resistor panel and the chassis.) A 5-mfd. unit may be used for replacement

RCA U-125

See also Case Histories listed for RCA U-128 receiver

Phono play-through on radio in Early U-125 instruments	1)	if it is desirable to completely void the phono-cross-talk on a particular instrument, it may be done at a slight loss of high-frequency response by removing capacitor C-15 and resistor R-11 from the circuit. Resistor R-11 has a gray body, red end, and yellow band; and is attached between the volume control tap and a terminal strip located adjacent to the tandem control assembly. Its removal effects the necessary change
Reducing low-frequency response on phono	1)	connect a 500,000-ohm ¼-watt resistor directly across the pickup circuit. This resistor may be installed at the terminals of the crystal cartridge under the pick-up head
Mechanical hum resulting from motor vibration	1)	a more flexible cushion should be used to support motor bracket to cabinet. Replacement Stock *No. 31541* will include two sets of rubber cushions, one *gray* colored and the other *black*. The gray one is quite flexible whereas the black one is relatively stiff
Phono motor speed "drifts" at slow rate, or shifts erratically to another speed	1)	see remedy for this Trouble Symptom listed under RCA R-98 receiver
Governor "chatter" and noise in phono motor	1)	see remedy for this Trouble Symptom listed under RCA R-98 receiver

RCA U-126

See also Case Histories listed for RCA 98K receiver

Inoperative, Noisy	1)	inner connections of *C-31* loose. Replace, using flexible leads
Phono motor speed "drifts" at slow rate, or shifts erratically to another speed	1)	see remedy for this trouble listed under RCA R-98 receiver
Governor "chatter" and noise in phono motor	1)	see remedy for this trouble listed under RCA R-98 receiver

RCA 127

Servicing caution note	1)	this receiver operates from a 220-volt d-c line. When working on one be sure there is a knob on the shaft of the main tuning condenser, as in many cases its potential is 220 volts above ground and a shock will be received if the bare shaft is touched

RCA 128, 128E

Inoperative	1)	grid lead to 6B7 tube grounding to shield cable

(Cont'd)

RCA 128, 128E—*(Cont'd)*

Inoperative (no screen voltages)	1)	"shorted" 4-mfd. screen by-pass condenser (*C-16*)
Inoperative on "B" band	1)	holding soldering iron close to (but not touching) the coil winding until the wax melts and flows. Resolder all lugs on coil. Allow to cool, and realign receiver
Inoperative, except at one point on broadcast band	1)	"shorted" oscillator section of condenser gang. Separate the bonding pigtail from the stator connection
Stations received at two points about 20 kc apart—with distortion between these two points	1)	"shorted" or "leaky" 0.05-mfd. i-f grid filter condenser
Intermittent reception, Inoperative	1)	open-circuiting 10,000-ohm screen voltage-dropping resistor
Weak reception, Choking, Distortion	1)	"leaky" or "shorted" 4-mfd. cathode by-pass on 6B7. Condenser is mounted on terminal strip near rear wall of chassis under the 6B7 socket
	2)	"open" 0.02-mfd. 6B7 plate coupling condenser *C-39*
Fading, Oscillator drift	1)	snapped tabs on oscillator series condensers
	2)	lumps of solder at soldered connections of oscillator series condenser contacting metal jacket
Motorboating sound	1)	"open" 4-mfd. screen by-pass condenser *C-16*
Vibration, Rattle	1)	make dial glass window and frame secure
Slipping dial in "fast" tuning position	1)	insufficient tension of three spring clips on drive shaft
Dial slips	1)	push down three copper fingers on reduction device (with dial set for vernier tuning) to increase tension

RCA U-128

See also Case Histories listed for RCA 98K receiver

Tuning dial sticks, Tuning dial noisy	1)	align gears coupling driving motor to dial mechanism under chassis so they mesh smoothly. Lubricate sparingly
Turntable "flutter" or "wow"	1)	install specially designed motor coupling assembly (Stock *No. 31146*) which has an auxiliary flexible rubber coupling that mechanically filters the higher-frequency speed variations. Its effect on the common type of "once around" wow is not appreciable, but it will filter out variations occuring several times (4 to 8 per turntable revolution. When installing motor using this coupling, first assemble motor support in cabinet with motor screws loose. Move motor around until the hub of coupling *No. 31146* can be pushed up around turntable spindle sleeve as a centering pilot. Tighten motor mounting screws securely. Lower coupling *No. 31146* on motor shaft to normal position and tighten set-screws

RCA K-130

Inoperative	1)	check voltage divider

RCA U-130

See also Case Histories listed for RCA HF-2 and RCA U-128 receivers

Phono motor speed "drifts" at slow rate, or shifts erratically to another speed	1)	see remedy for this Trouble Symptom listed under RCA R-98 receiver
Governor "chatter" and noise in phono motor	1)	see remedy for this Trouble Symptom listed under RCA R-98 receiver
Phono mechanism jams	1)	bent or sprung main lever which makes roller on end of main lever jump off the cam groove and pass under nose of cam, where it sticks

RCA U-132, U-134

Short-wave signals fade so abruptly that a "barking" effect results	1)	increase speed of avc circuits by changing value of condenser *C-70* from 0.05-mfd. to 0.01-mfd.
Electric tuning mechanism operates noisily	1)	see remedy for this Trouble Symptom listed under RCA HF-2 receiver
Radio interference on phono in RCA U-132	1)	where crosstalk from a strong local station occurs during phonograph reproduction, a remedy may be effected by one or more of the following: (1) replace 6R7 tube, (2) check Victrola switch contacts, and (3) shield grid lead of 6R7 under chassis, extending shield as closely as possible to condenser *C-55*. Move position of condenser *C-55* to top of mounting strip close to side of chassis
Needle scratch in RCA U-134	1)	0.025-mfd. condenser *C-102* associated with the high-frequency tone control switch may be of the wrong value in some cases, check capacity and substitute a 0.025-mfd. condenser if necessary
	2)	use Victor "Red Seal" needles
To obtain more "brilliance" on record reproduction	1)	install complete "compensation pack" Stock *No. 32452* (which includes a special phono input circuit all encased and shielded). Locate this pack on chassis mounting panel 5 inches to right and 1 inch above bottom edge. Connect between pickup cable and "Victrola" jack on chassis. Disconnect resistors *R-101*, *R-102*, *R-103*, and capacitor *C-104* from circuit. See that capacitor *C-105* connects directly to "Victrola" jack
Phono motor speed "drifts" at slow rate, or shifts erratically to another speed	1)	see remedy for this Trouble Symptom listed under RCA R-98 receiver
Governor "chatter" and noise in phono motor	1)	see remedy for this Trouble Symptom listed under RCA R-98 receiver

RCA RP-139A Automatic Record Changer

Mounting studs on which main lever, cam-and-gear or trip pawl are pivoted loosen up	1)	caused by jamming of the main lever against the pawl pin at the end of change cycle due to one or more of the following reasons: (a) Long arm of main lever slides over thin pawl pin instead of pushing against it during first half of cycle. Check for bent arm or main lever (b) Trip pawl bounces back after being cleared away—due to vibration. Check phosphor-bronze trip-pawl spring for sufficient "drag" or pressure against pawl
Irregular operation	1)	check adjustment of main lever *No. 15*
Record knives strike edge of records	1)	records warped
	2)	record edges rough
	3)	knife adjustments incorrect. Readjust
Record not released properly	1)	adjust record shelf assemblies in respect to shaft by means of adjustment *"H"*
When playing both types of records mixed, needle either lands in 10-inch position on 12-inch record or misses record entirely	1)	increase tension of mixed record discriminating lever spring *"M"*

RCA 140, 141, 141E

Inoperative	1)	leakage or short-circuit between cathode and heater of type '2A7 tube
Inoperative on "C" and "D" bands	1)	faulty type '2A7 oscillator tube (even though it tests O.K.). Replace by substitution
Inoperative, (audio system O.K.) (high grid voltage and low plate and screen voltages on the type '2A7 tubes)	1)	short-circuit between detector coils *L13* and *L18* (receiver wiring diagram). The defect is usually at the beginning or end of the winding and the coil can easily be repaired. The coil should be doped and the receiver circuit should be aligned after it is replaced
Intermittent reception, Inoperative	1)	insufficient tension of wave-band switch contacts—or dirty contacts
	2)	open-circuiting coils in r-f or tuner assembly
	3)	short-circuiting trimmers within 1st i-f transformer
	4)	in model 140 receiver, the tone-control reactor may be defective. This is likely if all voltages etc. check O.K. Replace reactor
	5)	spasmodic "opening" of coil *No. L-35* in 140 and 140E receivers
Weak reception	1)	replace 2A7 tube. (A tube checker may not reveal the defect)
Weak reception on short-waves (low heater voltage)	1)	install a "booster" transformer in the heater circuit
Weak, distorted reception, Hum	1)	open-circuited section of output transformer primary

(Cont'd over)

RCA 140, 141, 141E—(Cont'd)

Whistling or squealing, Howling on strong signals	1)	shield the grid leads of the type '2B7 second detector tube
	2)	try by-passing electrolytic filter condensers and r-f and i-f by-pass condensers directly to ground with 200 to 1,000-mmfd. paper or mica condensers so as to present a lower-impedance path to ground than exists at present
Noisy, Intermittent reception	1)	loose elements in type '2A7 tube
Distortion (in 140 Model only)	1)	shunt a 40,000-ohm ½-watt resistor across the 2-megohm unit located in the grid circuit of the 2B7 second detector AVC tube
"Fuzzy" tone	1)	try replacing 53 tube. (A tube checker may not show up the defect)
Low-pitched hum, Weak, distorted signals	1)	"open" section of push-pull output transf. primary. Make ohmmeter check between either filament of rectifier and each plate of 53 tube
Hum at resonance	1)	change type '2B7 second-detector tube
	2)	shunt first audio '56 grid choke with 0.1-mfd. by-pass condenser
Code interference	1)	use 445-kc i-f transformer as wave trap in antenna circuit

RCA 143

Inoperative	1)	control-grid lead of type '75 detector tube grounding to shield
Inoperative, No plate voltage on 1st type '76 tube	1)	open-circuited 10,000-ohm series resistor
Intermittent, Noisy reception	1)	open-circuiting by-pass condensers in grid-return circuits of '6D6 or '6A7 tubes
Intermittent reception, Station hiss	1)	open-circuiting 0.05-mfd. grid filter condensers in r-f, i-f and first detector stages
Intermittent, Noisy reception, Fading	1)	poor contact on wave-band switch
Very weak response, Volume control ineffective	1)	replace volume control
Weak reception, No change in volume	1)	defective volume control. Arm not making contact
Volume drops abruptly when receiver is tuned to a station at low-freq. end of broadcast band	1)	check 360-mmfd. series condenser connected across the padder condenser (located on rear wall of chassis) for snapped connecting tabs—or drops of solder making intermittent contact with its metal jacket
Gradual loss of sensitivity	1)	replace condenser in grid filter network on 56 amplifier stage—(this applies to the model having a 2-resistor grid network)
Fading, Oscillator drift	1)	snapped connecting tabs of oscillator series condenser
	2)	end connections to oscillator series condenser contacting metal jacket
Noisy reception, Grinding, rasping, with volume control turned to minimum	1)	noisy primary of push-pull input transformer

(Cont'd)

RCA 143—(Cont'd)

Noisy, Intermittent hum	1)	replace 500-ohm cathode resistor on 76 tube
Periodic hum with distortion	1)	replace 1st audio cathode by-pass condenser C-45 with 10-mfd. 50-volt unit. Replace 4-mfd. 450-volt electrolytic connected from same cathode to B-plus
Slipping dial in "fast" tuning position	1)	insufficient tension of three spring clips on drive shaft
Dial slips	1)	push down three copper fingers, with dial set for vernier tuning
Replacement condenser ratings	1)	whenever servicing one of these chassis, make sure that the 0.1-mfd. condensers C-14, C-30, C-39 in the set have a rating of 400 volts or higher. If not, replace

RCA RP-145 Automatic Record Changer

See also Case Histories listed for RCA RP-139A Automatic Record Changer

"Wow"	1)	defective record
	2)	oil, grease, dirt or other foreign matter on motor spindle, main driving disc or idler pulley rubber tire. Clean with any quick-drying naphtha. Also, move motor support bracket "N" in its mounting holes until the motor spindle is parallel to the turntable spindle and exactly at right angles to the main driving disc "29." Then securely tighten the bracket mounting nuts

RCA RP-151 Automatic Record Changer

Records will not fit properly on the three record posts	1)	record post spacing incorrect. Turn the record support to the 10-inch position. Loosen the two set-screws "A" on the front and on the rear separator belt drums. Move the front record separator post until its shaft is 1/64 from the end of the motorboard slot. Turn the belt drum to take up the slack in the belt and tighten the zinc-plated screw being certain to maintain the 1/64-inch spacing. Repeat the adjustment on the rear separator post. Check by placing a 10-inch record on the shelves posts and then tighten the copper-plated screws. Care should be taken to leave a small vertical clearance between the belt drum and the motorboard. The 12-inch position is automatically maintained
Records fail to drop at proper time	1)	record shelf timing incorrect. Place a 10-inch record on the shelves so that it contacts the front and rear record separator posts. With the changer out-of-cycle loosen the two set-screws "B" on the front and on the rear record separator shaft collars, and turn the record separator shaft until the record separating knife is 3/32-inch away from the record edge. Position set screw collar bottom edge 1-3/32 above the bottom plate. Tighten the zinc-plated screw, run through cycle several times as a check, then tighten the copper-plated screw. Repeat the adjustment on the rear separating knife
Pickup feeds into record grooves incorrectly	1)	instrument is not level
	2)	pickup cable binds
	3)	the feed-in spring has no effect until just after the pickup has landed. It then springs back to its original position, pushing on the trip lever stud and moving the pickup toward the music grooves. When feeding in on the top side of a record the feed-in spring is assisted by the rotational force of the record; on the bottom side feed-in this force opposes the feed-in spring's action. The feed-in screw should be adjusted so that the sapphire does not jump grooves on top side feed-in and still accomplishes bottom side feed-in in less than ten seconds.
Sapphire fails to land at proper point	1)	tone arm position incorrect with respect to "trip lever." Place a 10-inch record on the turntable and rotate the changer through cycle until the sapphire is just ready to land. Place a 0.005 feeler between the shoulder on the tone arm pivot shaft and its ball bearing. Loosen the set-screws "C" on the tone arm pivot shaft collar. Make certain that the tone arm return lever is against the record separator shaft and the pin on the trip lever is against the tone arm return lever. Move the tone arm to the point of proper landing, be sure the set-

(Cont'd)

RCA RP-151 Automatic Record Changer—*(Cont'd)*

		screw collar is up against the tone arm pivot shaft bushing, then tighten the zinc-plated screw. Run through cycle several times as a check, then tighten the copper-plated screw. Remove feeler. The 12-inch landing is then automatically correct
Spindle fails to pick up record, or turntable fails to drop the record	1)	remove the counterbalance spring. Loosen set-screws "D" on the U-shaped yoke supporting turntable pivot shaft. Centrally locate the turntable with respect to the front and rear edges of the motorboard slot by sliding the turntable pivot shaft in its bearings. Mesh the sector and segment gears as shown. Holding them in this position, move the turntable assembly until the turntable is level. Tighten set screws "D"
Turntable does not return to proper position	1)	turntable vertical position incorrect. Loosen set-screws "E" on counterweight arm. Set the counterweight. Check to see that there is clearance between the two set-screw collars (D-E) and the turntable pivot shaft bearing. Tighten the zinc-plated set-screw "E," run through cycle several times as a check, then tighten the copper-plated set-screw "E." Replace the counterbalance spring
Sapphire fails to clear record on turntable	1)	rotate the changer through cycle until the tone arm has moved into its cycle position. Adjust the screw "F" at bottom of tone arm elevating rod until the sapphires are equidistant from the two sides of the record. Then tighten the lock nut
Sapphire jumps grooves intermittently	1)	check dress of pickup cable in motorboard slot, making certain that it is free over the full range of tone arm movement
Top sapphire jumps grooves, or pushes too hard against record	1)	top sapphire pressure incorrect. Adjust the screw "G" in the rear of the tone arm until the pressure measured at the point of the top sapphire is approximately one ounce
Bottom sapphire jumps grooves, or pushes too hard against record	1)	bottom sapphire pressure incorrect. Adjust the *eye screw* and locknut "H" (under the second shelf and near the screw "F" at bottom of tone arm elevating rod) as shown until the pressure measured at the point of the bottom sapphire is approximately one ounce. With no-load setting of scale adjusted to read two ounces, bottom pickup should be pushed away from record by pressing down on it with the scale. Sapphire pressure should be adjusted to a scale reading of one ounce
Sapphire lands properly but fails to feed into music grooves, or feeds in too fast and jumps several grooves	1)	feed-in spring out of adjustment. Adjust the feed-in spring by means of the adjusting screw "I" until the sapphire feeds in smoothly without jumping grooves. Check to see that the spring clears the trip lever pawl and that the mounting screw is tight. Be sure to keep the viscoloid free from grease
Sapphire repeats grooves intermittently	1)	feed-in spring is striking the trip lever pawl
Sapphire repeats grooves near beginning of record	1)	the mercury switch is operated to break the a-c supply to the cycling motor a few moments before all the cycling operations are completed. The "coast" of the mechanism should then bring the tone arm lever stud against the return lever latch and disconnect the return lever from the trip lever. If excessive friction anywhere in the cycling motor or its gear train reduces this "coast," the pickup will land and repeat grooves near the beginning of the record. Eliminate any such friction
	2)	push mercury switch well into its mounting clip
	3)	trip pawl "binds"
Turntable too high or too low	1)	turntable height requires adjustment. Loosen locknut and adjust the turntable bottom bearing screw until the bottom of the turntable is above the motorboard. Tighten the locknut
Motor fails to reverse at proper time	1)	reversing switch position incorrect. Loosen the reversing switch mounting screw. Rotate the changer through cycle until the main cam has forced the trip lever to its outermost position. Move the switch until the reversing cam has fully compressed the switch against the spring. Lock in position with the mounting screws

(Cont'd)

RCA RP-151 Automatic Record Changer—*(Cont'd)*

Last 10-inch record drops before next to last record is out of the way	1)	delay the knife timing by placing a ⅛-inch spacer between the separator lever and the bottom bushing and then making adjustment by loosening the two set-screws "B" as above
Separating knife jams on record edge	1)	record "warped." Irregularities on the record separating knife and shelf teeth impeding the "elevating search" feature of the knife. Spacing washer too thick
Record on turntable strikes swivel posts	1)	tighten the belt drum springs by taking off turns
Mechanism trips too early	1)	off-center record
	2)	trip pawl not aligned with ratchet lever teeth
	3)	spring on trip lever too strong
	4)	turntable spindle bent
	5)	mercury switch lever bent
Mechanism trips continuously	1)	weak or missing spring on reject lever
	2)	ratchet lever binds on pivot
	3)	ratchet lever spring weak or missing
	4)	mercury switch lever bent
	5)	cycle motor leads are interfering with movement of mercury switch
Mechanism fails to trip or cycle	1)	eccentric groove on record too shallow, or discontinuous
	2)	defective mercury switch, circuit, or motor
	3)	cycling switch trip lever binds on bottom plate
	4)	ratchet lever binds at pivot
	5)	burrs on ratchet lever
	6)	ratchet lever spring too strong
	7)	reject button lever has jumped to wrong side of reject lever
	8)	reject button binds
	9)	mercury switch pivot lever spring too strong, or lever fouled by switch leads
	10)	burrs on end of cycling switch trip lever and the stud against which it works. Smooth off
Mechanism jams	1)	stud on main cam and stud on star wheel have hit head on. This generally results when operator improperly positions the control lever and leaves it midway between the "One Side" and the "Two-Side" positions
Control lever can be pushed to only one position	1)	check position of index lever with respect to the control lever shaft. When the control lever is in the two-side position, the star wheel lever stud should be at the end of the index lever slot nearest the control lever shaft. A set screw in the index lever hub permits positioning of the index lever
Slow speed, Varying speed	1)	motor support spring tension is incorrect
	2)	turntable drive wheel or tire "cocked." Bend bracket supporting drive wheel to straighten wheel
	3)	idler wheel or tire cocked
	4)	incorrect tension in drive wheel bracket spring
No output, Low output, Distorted output	1)	defective crystal in pickup
	2)	shield over terminal board "shorting" to cable lugs
	3)	sapphire strikes guard
	4)	"loose" nut on sapphire holder shaft
	5)	cycling switch pivot lever bent
	6)	switch not inserted far enough in mounting clip
	7)	cycling motor stops too late, or too soon, closing pickup "shorting" switch
	8)	pickup cable "open," or "shorted"
	9)	damaged sapphire
	10)	sapphire guard rides on record
	11)	"shorting" switch leaf bent
Unequal output from the two pickups	1)	adjust the trimmer capacitors until the outputs are at the same level. Since there is a slight interaction between the trimmers it may be necessary to repeat the adjustment a second time

RCA RP-152, RP-152A Automatic Record Changer

See also Histories listed for RCA RP-139A Automatic Record Changer

Tendency to stall	1)	if motor is identified by stamping No. 91706-1, this trouble may be due to motor bearings becoming misaligned with respect to motor spindle. In most cases, the motor spindle may be freed by tapping the stator laminations while the motor is in operation. For a permanent remedy, install an idler wheel assembly to reduce side thrust on the

(Cont'd over)

RCA RP-152, RP-152A Automatic Record Changer—*(Cont'd)*

Tendency to stall —*(Cont'd)*		motor bearings. The following parts are required—one Stock *No. 36274* idler wheel, one Stock *No. 36275* idler wheel arm, one Stock *No. 33726* "C" washer for idler wheel, one Stock *No. 30585* spring for idler. To install: (a) remove one of the two motor support springs. (b) remove the turntable by removing the screw in the turntable spindle drive gear below the motorboard. (c) mount the idler wheel by means of a "C" washer on the single end stud of the idler arm. (d) install the idler assembly in place on the motor board as shown in accompanying sketch and fasten by means of the second "C" washer. (e) connect the tension spring between the end of the idler arm and the motorboard pin (below motorboard).
Intermittent starting, Slow speed, Stalling (in models already containing an idler wheel assembly)	1)	"binding" of idler wheel on its mounting stud. Smooth off and clear the idler wheel bearing so that it can rotate freely
"Stalling" going into cycle	1)	load the mechanism with one record on the turntable. If it stalls as it goes into cycle, check for insufficient tension in main lever spring or booster spring. An additional metal washer should be inserted between the spring and its guide
"Stalling" coming out of cycle (when pickup is at its farthest distance laterally from the turntable)	1)	too much tension in the booster spring. Any metal washers in this assembly should be removed

RCA 153 Test Oscillator

Signal leakage	1)	clean and adjust the spring contacts between case and front shield

RCA RP-153 Automatic Record Changer

See also Case Histories listed for RCA RP-139A Automatic Record Changer

Phono motor hum	1)	incorrect assembly of rubber grommets on two bolts that fasten motor-mounting plate to cabinet. Rubber sleeve must be centered on metal spacer so that motor plate cannot come in metallic contact with the spacer
Motor data	1)	should it be necessary to rebuild or service any of these motors in the field by replacing end heads or using new rotors and shafts, it must be noted that the rebuilt motors should be operated continuously for at least 48 hours before installation. The use of bronze bearings, diamond-bored for accuracy, together with the burnished steel shaft at the rotor provides a very close fit. As a result, the motor must be run-in approximately 48 hours, after which the oil has had a chance to fairly cover all contact surfaces of shaft and bearings, and a very smooth-operating long life bearing results

RCA ACR-155

5W4 rectifier tube fails during first few minutes of initial operation after receiver has been unused or stood idle for protracted period	1)	filter electrolytic capacitors have temporarily lost their capacitance or become "unformed." A very high surge current (beyond capacity of 5W4) is drawn by these capacitors, if in such a condition. In order to obtain correct operation, and proper forming of the capacitors, a 5T4 tube should be installed in the 5W4 position. It may be necessary to allow as much as 20 minutes after the set has been first turned "on" for the capacitors to form. Heating of the unit is normal during this period. The forming will be maintained indefinitely if the receiver is used frequently

RCA RP-155 Automatic Record Changer

Same Case Histories as those listed for RCA RP-139A Automatic Record Changer

RCA RP-158 Automatic Record Changer

Tone arm continues to repeat playing top record of stack	1) 2) 3)	record separator shaft, or spring on which it rests, binding on shaft bushing pin on record separator shaft binding in its slot shaft spring too weak
Improper landing on 10 and 12 inch records	1)	feed-in spring bent too far in front of tone arm return lever
Irregular landing on 10 and 12 inch records	1)	insufficient tension on belt
Loud "clicking" noise	1)	check mechanism timing adjustment. Make certain that pickup arm lever is not binding on its stud. Any jam will cause clutch to slip and produce the "clicking" sound
Mechanism jams, Tone arm continues to come down in "rest" position	1) 2) 3)	record separator shaft, or the spring on which it rests, is binding on the shaft bushing pin on record separator shaft is binding in its slot shaft spring too strong
Speed too slow	1)	adjust bottom bearing of turntable spindle to remove binding and permit free rotation. Check by applying power to turntable motor, allowing turntable to reach full speed, then pull motor away from turntable drive disc. Turntable should "coast" for at least twelve revolutions
Fails to track, Distortion	1) 2)	guard screw on pickup head strikes record sapphire loose or damaged. (Replacement sapphire is *Stock No. 39564*)
Trips continuously	1) 2)	"reject" button "binds" in its bushing reject lever spring too weak, or reject lever is binding on its guide slots
Sapphire strikes motor board	1)	bend pickup arm support bracket until the sapphire clears the motorboard by approximately 3/32 of an inch

RCA RP-160, RP-160A, RP-160B

Mechanism trips continuously	1) 2)	check to see that ratchet lever engages drive cam pawl at end of change cycle. Bend lever if necessary bend control cam flat spring for greater pressure

(Cont'd)

RCA RP-160, RP-160A, RP-160B—*(Cont'd)*

Turntable does not stop automatically	1)	check for binding in "stop" button bushing
	2)	bend the flat bracket that limits outward movement of trip lever, so that pickup lands on the stop button
Turntable fails to start	1)	check spacing of stop switch contacts to be certain that weight of stop button does not open them
Loud "clicking" noise, Mechanism jams	1)	see remedy for this same trouble listed under RCA RP-158 Automatic Record Changer
Irregular landing on 10 and 12 inch records	1)	insufficient tension on belt
Tone arm continues to repeat playing top record of stack	1)	record separator shaft, or spring on which it rests, is binding on shaft bushing
	2)	pin on record separator shaft binding in its slot
	3)	shaft spring too weak
	4)	do not tighten set-screws on separator shaft collar enough to distort housing of separator shaft spring
	5)	do not oil record separator shaft
Tone arm continues to come down in "rest" position	1)	record separator shaft, or the spring on which it rests, is binding on the shaft bushing
	2)	pin on record separator shaft binding in its slot
	3)	shaft spring too strong
Sapphire strikes motorboard	1)	bend pickup arm support bracket until sapphire clears motorboard by approximately $\frac{3}{32}$ inch
Separator knife jams on last record of stack	1)	check separator knife edge. It should not be sharp enough to dig in and carry record up with it
Slow speed	1)	see remedy for this trouble listed under RCA RP-158 Automatic Record Changer
Correct sapphire pressure	1)	correct sapphire pressure is approx. 1¼ ounces. Pressure is governed by a spring inside end of pickup arm. Owing to fact that both aluminum and zinc castings (with resulting difference in weight) have been used for the arm and the crystal, and also that only the crystal for the zinc arm pickup is supplied for replacement, it is necessary to check the sapphire pressure whenever either the crystal or the arm is replaced. The zinc arm is identified by the letters *"ZN"* after the drawing number inside the arm. The zinc crystal is identified by the letters *"ZN"* molded at the rear end of the cartridge
Fails to track, Distortion	1)	guard screw on pickup head strikes record
	2)	sapphire loose or damaged

RCA RP-162 Automatic Record Changer

Mechanism trips continuously	1)	check to see that the ratchet lever engages drive cam pawl at end of change cycle. Bend lever if necessary
Loud clicking noise resulting from drive cam pawl slipping out of teeth in cam sprocket, Mechanism jams	1)	check mechanism timing adjustment. Make certain that pickup arm lever is not binding on its stud. Any jam will cause the clutch to slip and produce clicking sound

(Cont'd)

RCA RP-162 Automatic Record Changer—*(Cont'd)*

Sapphire strikes motorboard	1)	bend the pickup arm support bracket until sapphire clears motorboard by approximately $\frac{3}{32}$ of an inch
Separator knife jams on last record of the stack	1)	check the separator knife edge. It should not be sharp enough to dig in the record and carry the record up with it
Slow speed	1)	see remedy listed for this trouble under RCA RP-158 Automatic Record Changer. (In this changer, disengage motor from turntable by pulling idler away from turntable to observe "coasting" period)
Repeats grooves	1)	damaged sapphire. (Replacement sapphire for this pickup is *Stock No. 39564*)

RCA V-170

See also Case Histories listed for RCA VA-15 and RCA RP-152 Automatic Record Changer

Rumble	1)	caused by motor vibration. Reduce low-frequency response by shunting a 50,000-ohm ¼-watt resistor across crystal pickup terminals
Squealing	1)	if volume control setting varies it replace control

RCA V-175

Precautions for satisfactory performance	1)	dress bias cell up from chassis and away from a-c line switch
	2)	dress *R-13* (volume control compensation circuit) close to front apron
	3)	dress *C-9* between osc. coil and side apron
	4)	*black* lead from a-c line switch should be kept away from tone control leads and swifch
	5)	dress *R-22*, *C-32* (pickup compensation circuit) close to front apron
	6)	keep *R-4* and *C-5* bus (1st det. grid circuit) (socket end) as short as possible
	7)	*blue* lead to antenna terminal board should be dressed in back of i-f's
	8)	dress *brown* lead from volume control to tone switch close to front apron
	9)	dress *R-18* (output grid circuit) away from a-c line switch and a-c leads
	10)	dress lead to phono. socket up from chassis
Weak reception, Distortion	1)	check rectifier tube
	2)	if it hums check 25L6GT output tube
	3)	see that negative (small) end of bias cell connects to grid of 6SQ7

RCA V-200, V-201

See also Case Histories listed for RCA V-170 receiver

Speaker rattle	1)	shim speaker out from baffle board

RCA VHR-202

Rumble	1)	see that instrument is perfectly level
	2)	be certain that the motor-board and mechanism is "floating" free from the cabinet. All four mounting springs should be at approximately equal tension
	3)	see that the follower-arm lead damping weight is in place, attached to the follower arm underneath the motor-board
	4)	make sure that a *perfect* stylus is *tightly* inserted in the cutter-head. Because both stylus and retaining screw are of hard steel there is a tendency towards loosening during cutting. Tightness should be checked before each cut
	5)	set for sufficient input level so that the "Magic Eye" just closes on modulation peaks
	6)	during recording, the power-bass control should be set for maximum lows, just beyond the click of power switch. The treble tone control setting will depend on the degree of potential rumble pre-

(Cont'd over)

RCA VHR-202—*(Cont'd)*

Rumble —*(Cont'd)*		sent. For extreme cases, it should be set for minimum highs *during recording only*, in order that the low-frequencies in the *selection* or *voice* may have a full chance to mask any possible rumble
	7)	during recording, the shavings should be directed towards the spindle and prevented from obstructing the cutter path. The thickness of these shavings should be about that of human hair, or approximately .003 inch. An additional check on depth of cut is to inspect the recording under a magnifying glass. The groove width should approach but not exceed the distance between grooves. Depth of cut may be varied by means of the cutting-pressure adjusting screw at the top of cutter arm
	8)	if rumble persists, inspect the idler wheel (between motor spindle and turntable) for possible runout, flat spots, and scraping against bottom of turntable
	9)	due to variations in material composition and hardness among different types of discs, the same cutting-pressure adjustment will not give an equal depth of cut on all types. Thus, it may be necessary to change the adjustment previously set for one type of disc, when recording on a different type
General irregularity of operation	1)	with changer "out-of-cycle," the roller on main lever should clear the cam plate by 1/16-inch. Bend the rubber bumper stud, if necessary, to obtain this clearance
Fails to trip at end of record	1)	increase clutch friction by turning clutch screw clockwise
Needle repeats grooves (does not follow the groove), Change cycle starts before record is finished	1)	decrease clutch friction by turning clutch screw counter-clockwise
	2)	these troubles may also be caused by a defective record, binding of the pickup-arm bearing, twisted pickup output cable, or rubbing between the friction finger and the index-lever finger
Pickup arm strikes lower record in stack, Pickup needle drags across top record on turntable	1)	rotate the changer "in-cycle" to the point where the pickup arm is raised to its maximum height above turntable plate, and has not started to move outward. Adjust the lift-cable screw and locknuts so needle point is 1-inch above top surface of turntable
Needle doesn't land at correct point on 10-inch record (The correct landing point is 4⅝ inches from the nearest side of the turntable spindle)	1)	place 10-inch record on turntable, push record-discriminating lever to forward position, push index lever to "reject" and return it to "10." Rotate mechanism through cycle until needle is just ready to land on record. Hold pin on locating lever against step "T." Loosen the two set-screws at pickup arm shaft, and move pickup so needle is about 1/32-inch beyond the outer groove of record. See that there is 1/32-inch play between the pickup arm bearing and set-screw collar, then tighten one (the blunt nose) set screw
		Run mechanism through cycle as a check, and then tighten the cone-pointed set-screw
Needle doesn't land at correct point of 12-inch record (The correct landing point is 5⅝ inches from the nearest side of the turntable spindle)	1)	adjust for correct 10-inch landing, as described above, then place 12-inch record on turntable, push index lever to "reject" and return it to "12." Rotate mechanism through cycle until needle is ready to land on the record. Turn eccentric stud to bring pickup needle about 1/32-inch beyond the outer groove in record. (Keep eccentric on stud toward rear of motorboard as indicated.)

(Cont'd)

RCA VHR-202—*(Cont'd)*

Record knives strike edge of records (This is generally due to warped records, and records with rough edges)	1)	it is essential that the spacing between the knife and the record shelf "27" be accurately maintained. The spacing for the 10-inch record is nominally .058 inch, and for the 12-inch record is .075 inch. To adjust, rotate the knife to the point of minimum vertical separation from the record shelf and turn screw and locknut "F" to give .055—.061 inch separation. Screw "G" must not be depressed during this adjustment. After setting screw "F," adjust screw "G" so that when its tip is depressed flush with top of record shelf, the vertical spacing between the knife, in its lowest rotational position, and the shelf, is .072—.078 inch.
Records are not released properly, or do not fall flat (If record shelves are bent, or not perfectly horizontal, improper operation and jamming of mechanism will result)	1)	place a 12-inch record on the turntable, rotate mechanism to point in cycle where the shelves have turned clockwise as far as the mechanism will turn them. Lift record up so it is in contact with both knives and check clearance between record and edges of shelves. It should be 1/16-inch as shown. If the clearance at either or both shelves is not correct, loosen set-screws "H" and shift the shelves to obtain this clearance, with the backlash taken up by pressing the shelves toward the record. Tighten one set-screw (the blunt-nose one), run mechanism through cycle several times to check action, then tighten the other (cone-pointed) set-screw
Pickup arm support bent too low, or too high	1)	bend the support (which is associated with the pickup arm bearing, so that with the mechanism out of cycle, the lower front edge of the pickup arm is 5/16-inch above surface of motorboard
Roller on main-lever won't enter cam	1)	bend the trip pawl stop pin so that the roller on end of main lever, when entering the cam, will definitely clear the cam outer guide plate as well as the nose of the cam plate. (Adjustment "K.")
Needle lands in 10-inch position on 12-inch record, or misses record when playing both types mixed	1)	increase pressure of flat spring "M" at bottom of record discriminating lever
Needle fails to enter starting groove	1)	raise the right-hand side of cabinet by placing thin spacers under legs.
Needle slides over a few grooves in landing	1)	raise the left-hand side of cabinet by placing thin spacers under the legs

RCA V-205

Radio breakthrough on phono	1)	due to capacity coupling between i-f 6SK7 *plate* lead and 6F6G grid leads. Dress the 6F6G grid leads down against the chassis well well away from the plate lead
Noisy (even when volume control is turned down)	1)	try new 6F6G output tubes
Hum (not due to filter)	1)	reverse connections of voice coil humbuck coil
Distortion and crackling noises	1)	check voltage divider
To increase sensitivity	1)	untuned r-f stage is resistance-coupled to 1st detector. Sensitivity may be increased by changing r-f plate load resistor to a higher value between 6,000 and 10,000 ohms

(Cont'd)

RCA V-205—*(Cont'd)*

Loosening of the record changer mounting studs on which the main lever, cam-and-gear, or trip pawl are pivoted	1)	see remedy for this Trouble listed under RCA VA-15 receiver

RCA VHR-207

See also Case Histories listed for RCA VA-15 and RCA V-205 receivers

Rumble	1)	see remedy listed for this Trouble Symptom under RCA VHR-202 receiver
Breakdown of condenser *C-53* in phono recording cutter circuit	1)	replace 470-mmfd. faulty condenser (*black* color) with new higher voltage rating condenser Stock No. 30433 (*grey* color)
Caution	1)	when shooting trouble or testing *do not* under any circumstances "short" the B+ circuit to ground with a screwdriver or any other tool as a test for plate voltage. A short in the B+ line will burn out the filament of the 12K7-GT microphone pre-amplifier tube. Always test for B+ voltage on the chassis with a voltmeter and not with a screwdriver or other tool

RCA 210

Fading, Intermittent operation, Cutting in and out	1)	faulty 0.1-mfd. 400-volt cathode by-pass condenser on 58 and 2A7 tubes

RCA 211

See also Case Histories listed for RCA 117 and RCA 118 receivers

Weak, distorted reception	1)	check condensers *C-26, C-29, C-30*
Distortion, Squawking	1)	check *C-26* electrolytic condenser for partial or complete "short"

RCA 211K

Weak reception on "C" band	1)	if an outside antenna is being used, adjust antenna condenser *C-7* for peak output on a station in the 31-meter band

RCA VHR-212 (Chassis No. RC-574)

Sapphire in phono pickup strikes motorboard	1)	bend pickup arm support bracket until sapphire clears motorboard by approx. $\frac{3}{32}$ in.
Fails to track, Distorts	1)	guard screw on pickup head strikes record
	2)	sapphire loose or damaged
Record changer trips continuously	1)	bend the control cam flat spring for greater pressure

RCA 214

Sputtering noises when set is first turned on (not affected by volume-control setting)	1)	see Case History for this same trouble symptom listed for RCA 117 receiver

RCA 220

Inoperative on low-frequency end of dial	1)	"shorted" 4-mfd. condenser (*C-24*) connected from junction of oscillator coil and 20,000-ohm resistor (*R-7*) to chassis
Inoperative (no oscillator plate voltage)	1)	"open" 20,000-ohm oscillator plate series resistor
	2)	"shorted" oscill. plate by-pass condenser
Whistling or squealing, Motorboating sound, Distortion	1)	oscillator out of alignment
	2)	loss in capacity of oscillator plate by-pass cond.
	3)	faulty 2B7 tube (even though it may test O.K.). Replace
	4)	poor shielding on leads running to the control-grid and diodes of 2B7 tube
	5)	replace 1.5-megohm 2A5 resistor with a 150,000-ohm unit
Whistling or squealing steady or intermittent (may be started or stopped by snapping power switch or by turning a light on or off)	1)	"leaky" 4-mfd. by-pass condenser (*C-29*) across resistor in 2nd detector cathode circuit
Motorboating sound	1)	replace 1.5-megohm 2A5 grid resistor with a 150,000-ohm unit
Slow motorboating sound (present even if volume control is retarded)	1)	loss of capacity in condenser block. Replace

RCA 221

Inoperative on broadcast band (tubes and voltages test O.K.)	1)	"open" 4-mfd. screen-grid circuit condenser located in power pack. Replace with 500-volt unit
Inoperative (no oscill. plate voltage)	1)	"open" 20,000-ohm oscillator plate series resistor
	2)	"shorted" oscill. plate by-pass cond.
Whistling, Motorboating sound, Distortion	1)	oscillator out of alignment
	2)	loss in capacity of oscillator plate by-pass condenser
	3)	faulty 2B7 tube (even though it may test O.K.). Replace
	4)	poor shielding on leads running to the control grid and diodes of 2B7 tube
Squealing (only when volume control is turned on full)	1)	check all filter condensers. Replace 8-mfd. section having *red* leads
Hum	1)	"leaky" 4-mfd. condenser *C-22* (*No. 6703*). Disconnect *blue* lead and replace

RCA 222

Distortion	1)	"leaky" 0.02-mfd. plate-to-grid audio coupling condenser *No. C33*. Replace with 600-volt type

RCA 223 (32-Volt Receiver)

Ballast tubes burn out often	1)	remove glass envelope from ballast tube. Solder leads to prongs and run them to a porcelain socket containing an ordinary 125-watt incandescent lamp. This gives rectifier and filament the correct voltage when the line is 40 volts

RCA 224

See also Case Histories listed for RCA 128 receiver

Weak reception (low plate and filament voltage)	1)	check for high-resistance in filament winding supplying '80 tube. Replace power transformer, if resoldering all joints in this circuit does not help
Temporary distortion (during distortion, voltages O.K. but milliamp. drain of output tube high)	1)	partial "short" in condenser *C-40*

RCA 226

Same Case Histories as those listed for RCA 128 receiver

RCA 240

Same Case Histories as those listed for RCA 140 receiver

RCA 241B

Intermittent reception	1)	corroded joints at points where leads are welded to coils (in both input and output transformers)

RCA 242

See also Case Histories listed for RCA 143 receiver

Fading	1)	replace all 0.01-mfd. grid circuit by-pass condensers in r-f and i-f stages. Use 0.1-mfd. units for replacement

RCA 260, 261

Intermittent reception, Station hiss	1)	open-circuiting 0.05-mfd. grid filter condensers in r-f, i-f and first detector stages
	2)	open-circuited secondary return by-pass condenser in second detector stage
Distortion, Lowered sensitivity	1)	open-circuited type '58 AVC—i-f tube cathode bias resistor
	2)	overloaded 60,000-ohm 1-watt plate resistor. Caused by "leaky" or "shorted" 4-mfd. condensers (with *red* leads) located in condenser can and connected to each end of this resistor. Replace resistor with 2-watt unit. Clip *red* condenser leads and replace with two new 4-mfd. dry electrolytic units
Distortion at resonance	1)	open-circuited 300-mmfd. AVC coupling condenser (located inside first i-f transformer)

RCA 262

See also Case Histories listed for RCA 263 receiver

Sensitivity poor on short waves (intermittently, or steadily)	1)	check grid coil return by-pass condensers in the r-f, i-f and detector stages
Whistling on high-freq. end (with sensitivity control advanced)	1)	replace i-f cathode and screen by-pass condensers
I-f amplifier does not hold alignment	1)	solder r-f transformer leads to insulated eyelets through which they pass

(Cont'd)

RCA 262—*(Cont'd)*

Buzz or hum (in early-run receivers which employ the 76 or 1-V demodulators)	1)	remove the *red*-with-*yellow* tracer lead which junctions with the 10-mfd. electrolytic condenser (*C-56*) in the schematic and the lug on the resistor board. In place of this lead, install another (which will be located outside of the chassis cable) carried along the front side of the chassis, similar to the *red* lead connecting the corresponding points Then connect the grounding lead from the second detector cathode to a grounded point as near as possible to the detector socket. Check the secondary leads from the interstage transformer connecting to the driver stage. These leads should be kept as far as possible from the heater prongs and heater wiring. At the same time they should be as short as possible Make certain that the heater leads connecting the audio tubes are twisted
Intermittently loses almost all low-frequency response at *low* and *medium* volume levels	1)	check wave-band switch for dirty contacts
	2)	intermittent 0.25-mfd. 1st audio plate filter condenser
	2)	check *green* common lead of electrolytic by-pass condenser block. This should be grounded to the same chassis lug as one terminal of the tone-control reactor
Dial slips on "fast-speed" knob setting	1)	remove chassis from cabinet. Bend down the three contact springs on the tuning knob shaft

RCA 263

Intermittent reception, Volume level falls, Station hiss	1)	open-circuiting grid filter condensers in r-f, i-f and first detector stages
Intermittent reception, Noisy, Hum, Erratic operation of volume control	1)	replace volume control
Intermittent reception, Fading	1)	defective volume control
	2)	poor contacts on wave-band switch
Intermittent reception, Noisy	1)	open-circuiting type '6D6 or '6A7 grid-return by-pass condensers
Sudden increase in volume level followed by drop to original level	1)	pigtail of 60,000-ohm carbon oscill-grid resistor (connected to cathode terminal of 6A7 socket) "shorts" intermittently to the grounded terminal lug of the broadcast-band padding condenser. This removes bias voltage on 1st det.-oscill. tube and increases the gain. Move the resistor so it cannot touch condenser lug
Hum, Distortion, Usually weak reception	1)	leaky or short-circuited type '76 AVC cathode tube by-pass condenser
Noisy volume control	1)	isolate volume control from diode load circuit with condenser and resistor
Dial slips	1)	push three copper fingers down (with dial set for vernier tuning) to increase tension

RCA 280

See also Case Histories listed for RCA 260 receiver

Inoperative (plates of 80 and 5Z3 tubes red hot)	1) 2)	"shorted" condenser *C-32* "shorted" condenser pack
Weak, intermittent reception	1)	resolder all terminals on antenna coil
Weak reception, Poor control of volume	1)	carefully check fine leads of reactor coil connected to the volume control. It should test 3,200 ohms. See that it is not "open," and that its connections are good
Whistling or squealing	1)	"open" screen grid condenser *C-41*

RCA 281

Intermittent reception, Station hiss	1) 2)	open-circuiting grid filter condensers in r-f, i-f and first detector stages intermittently "opening" condenser *C-57*
Abrupt volume increases	1)	pigtail of 60,000-ohm carbon oscillator-grid resistor connected to 6A7 tube cathode terminal "grounding" to grounded terminal lug of broadcast-band oscillator padding condenser
I-f stages will not hold alignment	1)	solder r-f transformer leads to insulated eyelets through which they pass
Whistling or squealing on high-freq. end (with sensitivity control advanced)	1)	replace i-f cathode and screen by-pass condensers
Distortion on loud signals	1)	check 6D6 and 76 tubes in avc circuit
Hum	1)	check for mismatched 42 output tubes
Slipping dial	1)	insufficient tension of spring clips on drive shaft
Plate by-pass condensers (service note)	1)	when servicing any of these receivers, examine the following 0.1-mfd. plate by-pass condensers: *C-9, C-31, C-32, C-41, C-43, C-51.* If they are not rated at 400 volts or higher, replace

RCA V-300

See also Case Histories listed for RCA VA-15 receiver

Frying noises	1)	check each section of 3-section filter condenser No. 32240 for leakage
To increase phono gain in 1st Production receivers	1)	change *R-12* from 82,000 to 150,000-ohms. Change *R-13* from 2,700 to 5,600 ohms. Change *C-40* from 0.01-mfd. to 0.005-mmfd.

RCA V-301, V-302

See also Case Histories listed for RCA VA-15 and V-300 receivers

Motor hum	1)	see remedy for this Trouble listed under RCA RP-153 Automatic Record Changer
Mechanical motor noise	1)	caused by armature end play brought on by wear. Tighten armature thrust bearings. Do not make them too tight as armature will then bind

RCA VHR-307

Same Case Histories as those listed for RCA VA-15 receiver

RCA 321 Duo

Only phono reception, No radio reception	1)	"shorted" 4-mfd. 500-volt condenser having *blue* lead to terminal near oscillator padding condenser *Note*: be sure to include 30,000-ohm resistor in original position when replacing

RCA 327

Servicing caution note	1)	this receiver operates from a 220-volt d-c line. When working on one, be sure there is a knob on the main tuning condenser shaft, as in many cases its potential is 220 volts above ground and a shock will be received if the bare shaft is touched

RCA 330, 331

Radio or phono inoperative	1)	open-contacts on radio-phono transfer switch. Replace switch
No reception at low-freq. end of dial (oscill. fails to oscillate)	1)	check heater voltage on 2A7 tube. If low, install booster transformer
Intermittent radio or phono operation (no plate voltage on type '58 r-f tube)	1)	open contacts on radio-phono transfer switch. Replace switch
Fading	1)	"open" small tubular by-pass condensers. Replace
Weak, distorted reception (plate and screen voltages higher than normal)	1)	check for "open" 8,800-ohm field coil connected across rectifier output. A quick check, without disturbing leads or terminal covers, may be made with an ohmmeter connected from either rectifier filament to chassis. A reading of approximately 6,000 ohms should be expected if the field coil is intact. Should the ohmmeter disclose a d-c resistance of approximately 20,000 ohms, across the circuit, then the field coil is "open." (This latter reading represents the total value of the voltage divider system)
Noisy volume control	1)	isolate volume control from diode load circuit with condenser and two resistors
Noisy tone control	1) 2)	clean resistance element clean slider arm contact surfaces
Poor control of record volume, Sharp drop in record volume control action	1)	disconnect lead to center-tap of volume control resistance element
Wavering, vibrating record reproduction, Strong hum	1)	remove phono panel shipping blocks
Whistling or squealing (when volume control is set near "max")	1)	"open" 4-mfd. section in 10-4 mfd. electrolytic block located under power transformer
Station selector knob slips	1)	insufficient tension on the balls in the planetary drive. The housing of this drive assembly is secured to the front of the gang condenser by two screws which pass through the protruding ears

(Cont'd over)

RCA 330, 331—(*Cont'd*)

Station selector knob slips —(*Cont'd*)		on the housing. Remove only one screw at a time and spring back each side of the housing, to increase the tension on the balls
Buzz	1)	connect a 0.001-mfd. r-f by-pass condenser from center terminal of volume control to the side lug of control that connects to 60,000-ohm resistor
Pick-up lowers upon record, but needle does not slip into first groove	1)	re-adjust switch-lever locating screw
Pick-up lowers upon record, but needle skips several grooves	1)	re-adjust switch-lever locating screw
Mechanism fails to trip	1)	re-adjust tension of pawl trip
12" records bind against mechanism cover	1)	raise turntable by small washer inserted between turntable and spindle
Phono turntable runs slow, Phono turntable inoperative	1) 2)	bend up notched lever raise lever assembly with small washers

RCA 341

Very weak response (volume unaffected by volume control)	1)	poor contact of moving arm of volume control. Replace
Intermittent reception (volume level falls, accompanied by resonance hiss)	1)	open-circuiting 0.05-mfd. grid filter condenser in r-f, 1st-detector—oscillator and i-f stages
Volume level drops abruptly when receiver is tuned to a low-frequency broadcast-band station	1)	check 360-mmfd. series condenser connected across the padder condenser (located on rear wall of chassis) for snapped connecting tabs—or drops of solder making intermittent contact with its metal jacket

RCA Duo 380-HR

Testing neon level-indicator lamps	1)	connect suspected lamp (in series with a 200,000-ohm fixed resistor) across an a-c voltage source. This may be the regular 110-volt a-c supply line shunted by a suitable voltage-dropping potentiometer. Connect a high-resistance a-c voltmeter across output of potentiometer, and vary this adjustment. The lamp should not light before 52 volts is applied—and must not require more than 64 volts. If otherwise, it is faulty and should be replaced

RCA Duo 381

Intermittent reception, Station hiss	1) 2)	open-circuiting grid filter condensers in r-f, i-f and first-detector stages intermittently "opening" condenser *C-57*

(Cont'd)

RCA Duo 381—(*Cont'd*)

Abrupt increases in volume	1)	pigtail of 60,000-ohm carbon oscillator-grid resistor connected to 6A7 tube cathode terminal "grounding" to grounded terminal lug of broadcast-band oscillator padding condenser
Intermittent crackling noise	1)	replace both 6.3-volt dial lights as the originals are likely arcing in the filament wire
Slipping dial	1)	insufficient tension of spring clips on drive shaft
Phono mechanism fails to trip	1)	readjust tension of pawl trip
12" records bind against mechanism cover	1)	raise turntable by small washer inserted between turntable and spindle
Phono turntable runs slow, Phono turntable inoperative	1) 2)	bend up notched lever raise lever assembly with small washers

RCA V-405

See also Case Histories listed for RCA VA-15 receiver

Radio breakthrough on phono	1)	caused by capacity coupling between i-f 6SK7 plate lead and 6F6G grid leads. Dress 6F6G grid leads down against chassis well away from 6SK7 i-f plate lead
To increase sensitivity	1)	untuned r-f stage is resistance-coupled to 1st det. Change r-f plate load resistor to a higher value between 6,000 and 10,000 ohms

RCA VHR-407

See also Case Histories listed for RCA VA-15 and RCA VHR-207 receivers

Radio breakthrough on phono	1)	caused by capacity coupling between i-f 6SK7 plate lead and 6F6G grid leads. Dress 6F6G grid leads down against chassis away from 6SK7 i-f plate lead

RCA RC-408C

Improving performance	1)	change oscillator grid resistor *R-1* from 220,000 ohms to 150,000 ohms

RCA 415B

Same Case Histories as those listed for RCA K-60 receivers

RCA R-566 P

Distortion, Low volume	1)	leakage from 16-mfd. condenser to bolt heads of gang tuning condenser, placing positive voltage on the AVC circuit. Move coil that is directly over this condenser. Insulate the condenser can with insulating paper or tape. Put the coil back in its original position

RCA 810K, 810K1

Weak reception (all tubes check O.K.)	1)	check antenna coil and waveband switch for poor contact

RCA 811K

See also Case Histories listed for RCA 816K receiver

Inoperative	1)	"muting-switch" contacts on relay remain closed. Increase the spring tension so they open
	2)	"shorted" 4,700-mmfd. condenser *C-49* in plate circuit of triode-connected 6J7 oscillator
Inoperative (no plate voltage on 6N7 phase inverter)	1)	check 1,100-ohm section of Candohm resistor
Inoperative on broadcast band only	1)	"open" oscillator coil *L-13*
Noisy reception, Intermittent reception	1)	remove oscillator coil shield at top center of chassis and resolder all lugs on the coil
Distortion	1)	"shorted" or "leaky" 0.01-mfd. condenser *C-29* connected to phono input circuit
Noisy between stations on automatic tuning	1)	check for dirty "shorting" contacts on face of tuning motor. Clean
Noisy automatic tuning	1)	connect 0.1-mfd. condenser from "hot" side of tuning motor direct to chassis
Tuning motor stalls	1)	check the small gear at top of gear assembly—the one on which is mounted a small arm that engages a pin on the extended motor shaft when the motor is turned on. This gear may be worn, or in some cases, pressing down too tightly on the next gear in the assembly
	2)	at any point in the gear assembly where there is friction, use oil rather than grease. Many greases tend to dry out and harden from the heat developed by the tubes in the chassis. Ordinary light machine oil is best for the purpose
Automatic tuning mechanism stalls when pointer is at one end of dial scale	1)	replace motor-reversing switch (Stock *No. 14732*). Failure to replace this part promptly may cause stripping of gang condenser gear

RCA 812K

Only strong local stations received on broadcast band	1)	replace 690-mmfd. molded bakelite low-freq. oscill. padder conderser connected to broadcast band tap of oscill. coil
Afc pulls in at only one side of resonant point	1)	replace 22,000-ohm bleeder resistor connected from oscill. control tube cathode to Candohm resistor. A higher resistance value may also help. Realign r-f circuits
Noisy between stations on automatic tuning	1)	check for dirty "shorting" contacts on face of tuning motor. Clean

RCA 813K

See also Case Histories listed for RCA 816K receiver

Noisy between stations on automatic tuning	1)	check for dirty "shorting" contacts on face of tuning motor. Clean

RCA 816K

Afc pulls in at only one side of resonant point	1)	replace 22,000-ohm bleeder resistor connected from oscill. control tube cathode to Candohm resistor. A higher resistance value may also help. Realign r-f circuits
Adjusting reversing switch of automatic tuning mechanism	1)	adjust as low as possible to assure that it is *positively* actuated at the ends of the tuning range. Failure to reverse may result in a damaged "scissors gear" on the tuning condenser shaft. A satisfactory repair of this gear can be made, where necessary, as follows: (a) Remove compression springs from gears (b) Mesh and align both gears accurateately with pinion gear (c) Solder the movable and fixed gears together at each end (d) Readjust mesh with pinion and run through cycle several times to wear-in any irregularities (e) Readjust reversing switch as suggested: replacing same if questionable (Stock *No. 32167*)
Addition of resistor in circuit supplying indicating lamps	1)	resistor (Stock *No. 20647*), 1.8-ohms, with a five ampere maximum current rating, is now specified for use in the circuit supplying the "Music-Speech" and "Manual-Electric-Remote" indicating lamps. This part should be installed on all chassis of Models 813K and 816K requiring service in the field. It may be conveniently added to the circuit in place of the *brown* lead which connects from the front section of the range switch to the "Manual-Electric-Remote" switch
Replacing 100-mmfd. molded Luscite condensers connected in parallel with band-spread oscill. tuning condenser for short-wave operation	1)	these condensers are specifically designed to have a *negative* thermal coefficient of capacity to compensate for variations in other parts of the oscillator circuit with temperature changes. These condensers are, therefore, not interchangeable with ordniary types, and replacements should always be of the particular RCA stock number specified in the Replacement Parts Lists. Care must be exercised in replacing these parts, to avoid twisting the leads excessively and allowing too much heat to be applied when soldering

RCA 910KG

See also Case Histories listed for RCA 98K receiver

Electric tuning mechanism operates noisily	1)	see remedy for this Trouble Symptom listed under RCA HF-2 receiver

RCA 1939 Receivers with Electric Tuning Mechanism

The principle of operation of the tuning mechanism used in the 1939 line of receivers necessitates that the mechanism go through several quick reversals on arriving at the desired station frequency and before reaching a dead stop. Three or four reversals are not considered excessive and are within factory tolerance of adjustment. The number of reversals and consistency of operation depends mainly on the flywheel friction adjustment; however, in some cases the selector disc and station setting contacts are involved. The following suggestions may be helpful where excessive pointer oscillation is experienced in the field:

(Cont'd over)

RCA 1939 Receivers with Electric Tuning Mechanism—(*Cont'd*)

Excessive pointer oscillation on certain buttons only (related to selector disc)

1) check contact tip of selector assembly for loose fit in body. See that nose of contact is not burned nor distorted out of correct shape
2) clean the insulating gap of selector disc, being sure to remove all metal particles and metallic fragments from beveled edges of the brass. Each contact should be checked to assure that clearance exists (approx. 0.010") between it and the disc when stopped in position on the station
3) inspect the insulating gap to see that it has not changed shape due to bending or warping. Replace the disc if cleaning and adjustment fail to give correct operation

Excessive pointer oscillation on all buttons

1) slow oscillation indicates friction adjustment of flywheel is too tight. Loosen set screw slightly
2) rapid oscillation indicates friction adjustment is too loose. Tighten set-screw slightly
3) if definite adjustment cannot be reached, remove spring from behind flywheel set-screw and increase its length by stretching; replace and make the necessary adjustments. A heavier and stronger spring (Stock *No. 31242*) is supplied as replacement
4) see that leather friction pad is not binding in its hole, and that it is saturated with lubricant. "Neats-Foot" oil should be used for this purpose
5) the balance of the flywheel sometimes prevents correct adjustment. The standard service replacement flywheel (Stock *No. 31240*) may be used to definitely eliminate this cause
6) the number of oscillations varies somewhat with line voltage. Avoid making adjustments at very low (105v) or very high (125v) voltages. Adjustments made at 115-118 volts provide good operation of the rated range
7) stability of adjustment is slightly better if made after a brief run-in period

Push-buttons not latching

1) position of chassis in the cabinet with respect to the push-buttons is important in obtaining positive latching action. It may be necessary in some cases to elevate the front of the chassis slightly about ⅛ inch) by placing washers under its mounting feet, in order to obtain best operation

Mechanical motor rumble

1) under certain conditions related to acoustics of room, placement of instrument and general noise level, the mechanical noise of some electric tuning motors may be found objectionable. Should such a condition exist, it may be due to an unbalanced flywheel or noisy gear system. Check to see that intermediate gear (Stock *No. 31238*) is the "micarta" type, and that the flywheel (Stock *No. 3120*) is correctly "balanced." The standard replacement units meet these requirements

RCA AF-6505A Centralized Radio System

Hum (intermittent)

1) locate 1-megohm resistor connected between terminal *No. 3* on rear terminal strip (phonograph connections) and terminal *No. 6* on the resistor board. If the end of this resistor which is connected to terminal *No. 3* is "shorting" to termnial *No. 4*, insulate it

RCA VICTOR *(CANADIAN)*

For Case Histories of all Radiola, RCA, and RCA-Victor (*American*) receivers, see the pages immediately ahead of this section: See also the RCA and RCA-Victor *Canadian-American* receiver Cross-Index in *Section 6* of this *Handbook*

RCA-Victor *(CANADIAN)* R-7

(Use chassis similar to RCA R-7 receiver) See the Case Histories listed for the RCA R-7 receiver

RCA-Victor *(CANADIAN)* R-7A, R-8A

(Use chassis similar to RCA R-7A receiver) See the Case Histories listed for the RCA R-7A receiver

RCA-Victor *(CANADIAN)* R-8

(Uses chassis similar to RCA R-8 and R-10 receivers) See the Case Histories listed for the RCA R-8 and RCA R-10 receivers

RCA-Victor *(CANADIAN)* R-9A

(Uses chassis similar to RCA R-7A receiver) See the Case Histories listed for the RCA R-7A receiver

RCA-Victor *(CANADIAN)* R-10, R-12

(Use chassis similar to RCA R-10 and R-12 receivers) See the Case Histories listed for RCA R-10 and RCA R-12 receivers

RCA-Victor *(CANADIAN)* R-15

(Uses chassis similar to RCA R-11 and RCA Radiola 48 receivers) See the Case Histories listed for RCA R-11 and RCA Radiola 48 receivers

RCA-Victor *(CANADIAN)* R-20

(Uses chassis similar to RCA R-21, R-22, R-50 and R-55 receivers) See the Case Histories listed for RCA R-21, R-22, R-50 and R-55 receivers

RCA-Victor *(CANADIAN)* R-20R

(Uses chassis similar to RCA R-21 and R-22 receivers) See the Case Histories listed for the RCA R-21 and RCA R-22 receivers

RCA-Victor *(CANADIAN)* R-21

(Uses chassis similar to RCA R-50 and R-55 receivers) See the Case Histories listed for the RCA R-50 and RCA R-55 receivers

RCA-Victor *(CANADIAN)* R-22

(Uses chassis similar to RCA R-78 receiver) See the Case Histories listed for RCA R-78 receiver

RCA-Victor *(CANADIAN)* R-22A

(Uses chassis similar to RCA R-78 (2) receiver) See the Case Histories listed for RCA R-78 (2) receiver

RCA-Victor *(CANADIAN)* R-28

(Uses chassis similar to RCA R-28 receiver) See the Case Histories listed for RCA R-28 receiver

RCA-Victor *(CANADIAN)* R-29

(Uses chassis similar to RCA R-28P receiver) See the Case Histories listed for RCA R-28P receiver

RCA-Victor *(CANADIAN)* R-30

(Uses chassis similar to RCA R-43 receiver) See the Case Histories listed for RCA R-43 receiver

RCA-Victor *(CANADIAN)* R-31

(Uses chassis similar to RCA R-28P, 110, 111 and 115 receivers) See the Case Histories listed for the RCA R-28P, 110, 111 and 115 receivers

RCA-Victor *(CANADIAN)* RE-33

(Uses chassis similar to RCA RE-40 receiver) See the Case Histories listed for the RCA RE-40 receiver

RCA-Victor *(CANADIAN)* M-34

(Uses chassis similar to RCA M-34 receiver) See the Case Histories listed for the RCA M-34 receiver

RCA-Victor *(CANADIAN)* R-35

(Uses chassis similar to RCA Radiola 80 receiver) See the Case Histories listed for RCA Radiola 80 receiver

RCA-Victor *(CANADIAN)* R-37

(Uses chassis similar to RCA RE-16, R-37 receivers) See the Case Histories listed for the RCA RE-16 and R-37 receivers

RCA-Victor *(CANADIAN)* R-39

(Uses chassis similar to RCA Radiola 82 receiver) See the Case Histories listed for the RCA Radiola 82 Receiver

RCA-Victor *(CANADIAN)* RE-41

(Uses chassis similar to RCA RE-18 (AC) receiver) See the Case Histories listed for the RCA RE-18 (AC) receiver

RCA-Victor *(CANADIAN)* Radiola 48

(Uses chassis similar to RCA Radiola 48 receiver) See the Case Histories listed for the RCA Radiola 48 receiver

RCA-Victor *(CANADIAN)* R-49

(Uses chassis similar to RCA 330 receiver) See the Case Histories listed for the RCA 330 receiver

RCA-Victor *(CANADIAN)* R-50

(Uses chassis similar to RCA R-71 receiver) See the Case Histories listed for the RCA R-71 receiver

RCA-Victor *(CANADIAN)* R-52

(Uses chassis similar to RCA R-72 receiver) See the Case Histories listed for the RCA R-72 receiver

RCA-Victor *(CANADIAN)* R-53

(Uses chassis similar to RCA R-73 (with 47's) receiver) See the Case Histories listed for the RCA R-73 (with 47's) receiver

RCA-Victor *(CANADIAN)* R-54, R-56

(Use chassis similar to RCA R-74, R-76, R-77 receivers) See the Case Histories listed for the RCA R-74, R-76 and R-77 receivers

RCA-Victor *(CANADIAN)* RE-57

(Uses chassis similar to RCA Radiola 86 receiver) See the Case Histories listed for RCA Radiola 86 receiver

RCA-Victor *(CANADIAN)* RAE-59

(Uses chassis similar to RCA RAE-59 receiver) See the Case Histories listed for RCA RAE-59 receiver

RCA-Victor *(CANADIAN)* Radiola 80

(Uses chassis similar to RCA Radiola 80 receiver) See the Case Histories listed for RCA Radiola 80 receiver

RCA-Victor *(CANADIAN)* RE-80

(Uses chassis similar to RCA RE-80 receiver) See the Case Histories listed for RCA RE-80 receiver

RCA-Victor *(CANADIAN)* RE-81

(Uses chassis similar to RCA RE-81 receiver) See the Case Histories listed for RCA RE-81 receiver

RCA-Victor *(CANADIAN)* Radiola 82

(Uses chassis similar to RCA Radiola 82 and Radiola 82R receivers) See the Case Histories listed for RCA Radiola 82 and Radiola 82R receivers

RCA-Victor *(CANADIAN)* Radiola 86

(Uses chassis similar to RCA Radiola 86 receiver) See the Case Histories listed for RCA Radiola 86 receiver

RCA-Victor *(CANADIAN)* 90

(Uses chassis similar to RCA R-90 receiver) See the Case Histories listed for RCA R-90 receiver

RCA-Victor *(CANADIAN)* 101

(Uses chassis similar to RCA 100 and RCA M-101 receivers) See the Case Histories listed for RCA 100 and RCA M-101 receivers

RCA-Victor *(CANADIAN)* R-104, R-105

(Uses chassis similar to RCA R-7A receiver) See the Case Histories listed for RCA R-7A receiver

RCA-Victor *(CANADIAN)* R-107

(Uses chassis similar to RCA R-10 receiver) See the Case Histories listed for RCA R-10 receiver

RCA-Victor *(CANADIAN)* R-109

(Uses chassis similar to RCA R-21 and R-22 receivers) See the Case Histories listed for RCA R-21 and RCA R-22 receivers

RCA-Victor *(CANADIAN)* RO-112

(Uses chassis similar to RCA RO-23 receiver) See the Case Histories listed for RCA RO-23 receiver

RCA-Victor *(CANADIAN)* 118

(Uses chassis similar to RCA 118 receiver) See the Case Histories listed for RCA 118 receiver

RCA-Victor *(CANADIAN)* 122

(Uses chassis similar to RCA 221 receiver) See the Case Histories listed for the RCA 221 receiver

RCA-Victor *(CANADIAN)* 126B

(Uses chassis similar to RCA 223 receiver) See the Case Histories listed for RCA 223 receiver

RCA-Victor *(CANADIAN)* 128

(Uses chassis similar to RCA 128 receiver) See the Case Histories listed for RCA 128 receiver

RCA-Victor *(CANADIAN)* 140

(Uses chassis similar to RCA 140, 140E receivers) See the Case Histories listed for RCA 140, 140E receivers

RCA-Victor *(CANADIAN)* 143

(Uses chassis similar to RCA 143 receiver) See the Case Histories listed for RCA 143 receiver

RCA-Victor *(CANADIAN)* 211

(Uses chassis similar to RCA 211 receiver) See the Case Histories listed for RCA 211 receiver

RCA-Victor *(CANADIAN)* 221

(Uses chassis similar to RCA 221 receiver) See the Case Histories listed for the RCA 221 receiver

RCA-Victor *(CANADIAN)* 222

(Uses chassis similar to RCA 220 receiver) See the Case Histories listed for the RCA 220 receiver

RCA-Victor *(CANADIAN)* 223-B

(Uses chassis similar to RCA 223 receiver) See the Case Histories listed for the RCA 223 receiver

RCA-Victor *(CANADIAN)* 224

(Uses chassis similar to the RCA 224 receiver) See the Case Histories listed for the RCA 224 receiver

RCA-Victor *(CANADIAN)* 242

(Uses chassis similar to the RCA 242 receiver) See the Case Histories listed for the RCA 242 receiver

RCA-Victor *(CANADIAN)* 262

(Uses chassis similar to the RCA 262 receiver) See the Case Histories listed for the RCA 262 receiver

RCA-Victor *(CANADIAN)* 280

(Uses chassis similar to the RCA 280 receiver) See the Case Histories listed for the RCA 280 receiver

RCA-Victor *(CANADIAN)* 281

(Uses chassis similar to the RCA 281 receiver) See the Case Histories listed for the RCA 281 receiver

RCA-Victor *(CANADIAN)* 321

(Uses chassis similar to the RCA 321 Duo Receiver) See the Case Histories listed for the RCA 321 Duo receiver

RCA-Victor *(CANADIAN)* 331

(Uses chassis similar to the RCA 331 receiver) See the Case Histories listed for the RCA 331 receiver

RCA-Victor *(CANADIAN)* 381

(Uses chassis similar to the RCA Duo 381 receiver) See the Case Histories listed for the RCA Duo 381 receiver

RADIOLA

For Case Histories of Radiola receivers, refer to the RCA sections. All Radiola receivers are listed there in numerical order

RADIO PRODUCTS CO.

(See Case History listings under AIR CASTLE)

RECORDIO

(See Case History listings under WILCOX-GAY)

REMLER

REMLER 14

Whistling or squealing	1)	check for broken leads from tuning condenser to the tube caps
	2)	connect a 1 to 2-mfd. condenser across power supply
	3)	reduce detector screen voltage with 75,000-ohm resistor, and by-pass it to ground with a 0.002-mfd. condenser

REMLER 28 AC-DC "Scottie" (1937 Model)

Inoperative (with motor-boating sound all over dial)	1)	check insulating fibre washers on screws which hold dial plate on metal baffle. If they are cracked or broken, replace them

REMLER 36 Auto Radio

Noisy reception	1)	check for faulty r-f choke
	2)	"open" 0.05-mfd. or 0.1-mfd. filter condenser in "hot" battery lead to dynamotor
Weak reception	1)	increase in value of 15,000-ohm resistor in plate circuit of 76 2nd a-f tube. Replace

REMLER 40

Intermittent fading, Noisy reception	1)	check 0.1-mfd. by-pass condenser *C-9*
	2)	check 400-ohm 1-watt bias resistor *R-14* for the 41 tube
	3)	check 15,000-ohm 5-watt carbon 6A7 and 6F7 screen-dropping resistor *R-17*
	4)	check for faulty contact in volume control

REMLER 45 (1936 and 1937 Models)

Inoperative, Intermittent reception	1)	check 0.05-mfd. 600-volt tone condenser while shaking the set. If it is "shorting" intermittently, replace it

REMLER 46 "Scottie"

Hum	1)	if speaker contains a bucking coil, connect a 0.05-mfd. 200-volt paper condenser across field coil. If speaker does not have a bucking coil, replace the 4-4 mfd. 450-volt dry electrolytic condenser with an 8-4 mfd. 450-volt dual electrolytic—with the 8-mfd. section immediately following the rectifier
Hiss, Noisy reception, Intermittent hum	1)	check 15,000-ohm 5-watt 6A8 screen resistor
	2)	replace 4-4 mfd. dual electrolytic condenser
No control of volume	1)	"shorted" 0.1-mfd. (*No. 7039*) condenser on 6K7 and 6A8 cathode
Circuit improvement	1)	in early-model receivers 0.01-mfd. plate condenser is connected from 46 output tube plate to ground. As it receives high-voltage peaks in this position, its life may be greatly increased by connecting it instead across the output transformer primary (from plate to screen of the 46 tube)

REMLER 52

Circuit improvement	1)	in early-model receivers 0.01-mfd. plate condenser is connected from 42 output tube plate to ground. As it receives high-voltage peaks in this position its life may be greatly increased by connecting it instead across the output transformer primary (from plate to screen of the 42 tube

REMLER 60

Fading after operating for a few minutes	1)	internal "short" in *positive* legs of filter condensers *C-14* and *C-15*, thus "shorting" out the speaker field

REMLER 62

Reception cuts off with whistle at resonance on strong signal	1)	"leaky" 0.1-mfd. by-pass condenser across 6F6 grid-bias resistor

REMLER 64

Whistling or squealing at high-freq. end of short-wave band	1)	change 100,000-ohm (*No. 8*) resistor on oscillator input control-grid prong of 6A8 tube to 50,000 ohms. If oscillation persists when this is done, reduce this resistance to about 25,000 or 30,000 ohms

REMLER 71

Noisy on short-wave band, Microphonic noises	1)	thoroughly ground (at several places) the braided flexible wire which connects the rear end plates of all three sections of the tuning condenser to ground
Whistling on broadcast band	1)	connect a 0.0003-mfd. 6K7 audio plate by-pass condenser into the circuit if one is not already installed

REMLER-(Norco) 160

Weak reception (all voltages check O.K.)	1)	replace volume control with new ½-megohm unit

REMLER-(Norco) 178

Same Case Histories as listed for Remler 52 receiver

REMLER-(Norco) 180

Motorboating sound on low end of broadcast band	1)	replace 0.1-mfd. 6D6 tube cathode by-pass condenser with a 0.25-mfd. 200-volt condenser

---

ROCKOLA

ROCKOLA (all models using type '6B5 output tubes)

Intermittent noise	1)	type '6B5 tube becomes too hot. Substitute a new tube in place
	2)	replace condenser in tone-control circuit with a 0.001-mfd. tubular unit

---

ROGERS *(CANADIAN)*

ROGERS *(CANADIAN)* R-55

"Cutting-off" of reception, Whistling or squealing (at full-volume position)	1)	broken resistance strip inside the volume control

ROGERS *(CANADIAN)* "BATTERYLESS" 200A

"Popping" noise	1)	intermittent short-circuiting of tuning condenser plates, caused by vibration transmitted to chassis. Straighten out plates or replace tuning-condenser gang

ROGERS *(CANADIAN)* R-561

Distortion at low volume on local stations	1)	change the value of the 50,000-ohm resistor connected between the cathode and B-plus of the first type '58 i-f tube

ROGERS *(CANADIAN)* 645

Inoperative, Weak reception	1)	"shorted" by-pass condenser connected from chassis to 10,000-ohm resistor that is in series with input transformer primary. Also check this resistor for possible damage caused by overheating

ROGERS *(CANADIAN)* 725-A, 740-A, 755-A (using the spray-shielded tubes)

Noisy reception (replacing volume control does not cure the trouble)	1)	connect 0.3-megohm resistor and a 0.05-mfd. condenser in the grid circuit of the first a-f tube
Intermittent reception	1)	defective 0.05-mfd. condensers under the tuning condenser shield

ROGERS *(CANADIAN)* 741A

Intermittent reception, Hum, Distortion	1)	if 45 tube plate voltage drops to low value during trouble, check for intermittent "short" at terminals of 1,200-ohm bias resistor for these tubes

ROGERS *(CANADIAN)* 832

Inoperative (almost zero voltage on r-f plates)	1)	"leaky" 0.5-mfd. 500-volt 1st r-f plate by-pass condenser (this is 1 section of a dual 0.5-mfd. block shunted by a 50-ohm resistor). Replace the one faulty section with a 0.5-mfd. 500-volt tubular replacement condenser
Intermittent reception	1)	dirty contacts on tuning condenser rotor. Clean all contacts, and oil bearings

ROGERS *(CANADIAN)* 951

Inoperative, Intermittent reception	1)	open winding in band-pass i-f coil assembly
	2)	dirty contacts on tuning condenser rotor. Clean contacts, and oil bearings
Poor sensitivity (tubes and voltages check O.K.)	1)	defective 0.003-mfd. ground coupling condensers connected to either of the coils in the first i-f transformer (even though they may test O.K.). Replace
	2)	open-circuited primary winding in the push-pull input transformer, not usually apparent on account of the 20,000-ohm plate resistor which is shunted across it

ROGERS *(CANADIAN)* 4521 Chassis

Inoperative (rectifier plates red hot)	1)	"shorted" 8-mfd. metal-cased dry electrolytic condenser *C-31*. Clip and tape the dead leads to it. Place a new well-sealed 8-mfd. cardboard electrolytic condenser in the space at the left underside of the chassis. It will fit well in here

---

ROYAL

ROYAL A.C.-D.C. RECEIVER

Poor tone, Distortion (tubes test O.K.) (voltages slightly low on type '43 tube)	1)	solder a *No. 16* copper wire to all grounded terminals including the tuning condenser rotor contacts. Then solder this wire in turn to chassis, thereby obtaining a good low-resistance ground to chassis

---

SCOTT

SCOTT Custom Built Receivers

Whistling or squealing (in receivers using neon tubes as voltage regulators)	1)	by-pass high-voltage lead of neon tube to ground with a 0.5-mfd. condenser

SCOTT A.C. 10

Inoperative, Weak, (plates of push-pull 45 tubes red hot)	1)	"shorted" by-pass condenser across 45 tube grid-bias resistor
Noisy	1)	overheated or otherwise faulty toggle switch mounted on bronze name plate. Replace

SEARS ROEBUCK

(See Case History listings under SILVERTONE)

SENTINEL

SENTINEL 6-Tube Set

Intermittent reception, Buzzing, crackling and snapping noises	1)	vibrator requires adjustment. Increase its spring tension *slightly*

SENTINEL 14A

Weak reception at low-frequency end of broadcast band	1)	check for change in value of 50,000-ohm resistor connected from 540-1,730 kc oscillator coil to ground. Replace

SENTINEL 36L (32-volt Receiver)

Poor tone quality (mushy)	1)	excessive current in the 48 filament or pilot light circuit. This results in too much bias for the 76 driver. The voltage drop across the ½-ohm and 1.7-ohm sections of the resistance strip, *No. 2346*, should be about 1.9 volts. This is the proper bias for the 76 when the 48's and the pilot lights are drawing normal current. If either the 48's, the pilot lights, or both are drawing excessive current this bias may rise to as much as 3 volts. Because of the variation in the filament current drain of various 48 tubes and the pilot lights, in later productions of this receiver, a change has been made in the two sections of this resistor strip to compensate for the difference in tube characteristics. A 6.25-ohm flexible resistor, (Part *No. 2430*) is connected from the 1.7-ohm section to ground. All receivers in which this flexible resistor is shunted across the two sections of the resistor strip can be identified by the letter "A" stamped on the back of the chassis. In later production the 6.25-ohm resistor was not used; the entire resistor strip is replaced with another having the Part *No. 2525*. This chassis will be also stamped with the letter "A" *(Cont'd)*

SENTINEL 36L (32-volt Receiver)—*(Cont'd)*

Poor tone quality (mushy) —*(Cont'd)*		If one of these receivers is encountered with a "mushy" tone, try new 48 tubes and pilot lights or connect a 6.25-ohm resistor as follows: Looking at the bottom of the set and reading from the back to the front of the chassis, connect one side of the resistor to the third lug on the resistor strip (to which one side of the 32-volt power cord is connected) and the other end to the first lug of the resistor strip

SENTINEL 39B

Distortion, Rattling, Fuzzy reproduction (especially at high volume)	1)	connect a separate 0.003-mfd. by-pass condenser from each plate of output tube direct to chassis

SENTINEL 73B (late 1937 series)

Howling, Squealing	1)	clean the 0.5-meg. volume control
	2)	shield the grid lead from the 75 tube to grid-bias cell
	3)	install a 0.002-mfd. condenser from left side of volume control to ground

SENTINEL 90B

Fading due to frequency drift of oscillator (retuning receiver brings fading station back)	1)	replace oscillator coil (Part *No. 3429*)

SENTINEL 111

Noisy	1)	"noisy" 300,000-ohm resistor in detector plate circuit. Replace

SENTINEL 189LT (32-volt D.C. Receiver)

Interference from Wincharger or generator	1)	disconnect B+ end of 6SQ7 tube plate resistor and connect a ¼-meg. resistor in series with it. By-pass the latter to ground with a 0.1-mfd. tubular type condenser

SENTINEL 421 (Musicaire)

Hum at resonance point	1)	check for poor (high-resistance) ground

SENTINEL 550

Same Case Histories as those listed for Silvertone 550 receiver

SENTINEL 560, 561

Inoperative	1)	"open" 8-mfd. section in 8-8-4 mfd. condenser block. (The block is connected as follows: *black* lead is common negative. One 8-mfd. *blue* positive lead goes to one side of the filter choke, while the other 8-mfd. *blue* positive lead goes to the other side of the choke. The 4-mfd. *yellow* positive lead connects to the cathodes of the 25Z5 rectifier. All negative connections are independent of the chassis)

SENTINEL 660

Intermittent reception	1)	check speaker cable socket for loose or unsoldered connections

SERENADER

SERENADER 10-Tube

Intermittent operation	1)	intermittently "open" 0.01-mfd. coupling condenser between oscillator plate and grid. Check by testing for oscillator signal. Replace

SERENADER 47 Chassis

Smoking	1)	shorted filter condenser

SERENADER 160

Noisy reception, Intermittent reception	1)	defective r-f tube socket split at the plate prong, thus allowing the plate voltage to arc to ground. Replace

McMURDO SILVER

McMURDO SILVER Masterpiece VI

Motorboating	1)	try a new 6L7 tube
	2)	try the doublet as an L-type antenna. This will load the antenna coil properly

McMURDO SILVER 15-17

Weak reception on short wave band	1)	screen bleeder resistor near antenna lead shield channel changed in value. Replace with 15,000-ohm 10-watt unit

SILVER-MARSHALL

SILVER-MARSHALL (General Service Notes)

Frequency drift	1)	"warping" of oscillator padder condenser. Replace with an air-dielectric unit
Replacing dial cable	1)	remove all tubes. Remove shield around r-f section. Unsolder all connections to gang condenser. Remove three screws holding down condenser and remove entire gang with the drum. String on new cable, and replace the assembly
Weak reception in superhets using AVC	1)	try a number of tubes in the AVC socket until you find one which gives satisfactory results

SILVER-MARSHALL A

Low volume, Poor tone	1)	by-pass condenser across the type '47 tube bias resistor not of sufficient capacity. Replace with a 10-mfd., 25-volt electrolytic condenser

SILVER-MARSHALL "BEARCAT"

Volume control inoperative at low settings	1)	increase in value of the bleeder resistor connected from the volume control to B-plus, from 6,000- to over 35,000-ohms. Replace with a new unit
Hum (no screen-grid voltage)	1)	check the 10,000-ohm 5-watt resistor feeding the screen grids

SILVER-MARSHALL C

Hum, Poor tone, Low volume, Whistling or squealing between stations (plate voltages low)	1)	defective 2-mfd. filter condenser (*C21*). Replace with a new unit of large capacitance (about 4- or 8-mfd.)

(Cont'd)

SILVER-MARSHALL C—*(Cont'd)*

Intermittent reception	1)	defective 0.08-mfd. coupling condenser (*C16*). Replace with a 0.1-mfd. unit
	2)	intermittently defective resistors, *R5* and *R3*. Replace with 25,000- and 10,000-ohm units respectively

SILVER-MARSHALL F

Inoperative	1)	defective 10,000-ohm screen-grid feeding resistor. Replace with a 5-watt unit
	2)	defective 3-section by-pass condenser between the ground, the detector cathode and the plate and screen circuits.

SILVER-MARSHALL Q

Motorboating only at resonance and strong signals	1)	decrease in value of AVC plate resistor. Replace with new unit
	2)	leaky AVC tube plate by-pass condenser. Replace with new unit
Motorboating sound or distortion (with volume on full)	1)	faulty cathode bias resistor in i-f stage —replace even if it checks O.K. on ohmmeter

SILVER-MARSHALL R (10 Tube)

Inoperative (parts O.K.)	1)	i-f amplifier out of alignment
No signal when set is turned on but starts to play during first 5 or 10 minutes	1)	replace first filter condenser with 8-mfd. electrolytic unit
	2)	poor filtering in circuit acts as a signal on the AVC tube grid. If distortion and loud volume results when the AVC tube (first type '27 tube of row of three next to type 551) is withdrawn, and the set is tuned to a local station, then the fault lies in the AVC system
Motorboating sound, Excessive hum	1)	excessively high resistance in tone control (which is the plate resistor in detector circuit). If control checks O.K. replace 0.5-mfd. condenser from lower contact to ground with a 0.25-mfd. condenser, and connect a ¼-megohm resistor across the outer points of the tone control
	2)	test '27 second det. tube
	3)	check resistance value of resistor in the AVC circuit. If it is 2,500 or 3,500 ohms, replace it with a 12,000-ohm unit
To improve sensitivity	1)	replace the two '27 tubes in parallel (acting as 2nd detectors) with 56's
Insensitive (especially on low-freq. end of broadcast)	1)	replace 80,000-ohm cathode resistor *R-8* on detector. Also replace 3,500-ohm cathode resistor *R-7*
Signal fades out on weak station, changes tone slightly on powerful locals (tuning meter swings off-scale on left)	1)	oscillation in two i-f tube circuits. Connect a 1,500-ohm resistor in series with their plates. Increase the 0.1-mfd. plate and cathode by-pass condenser capacities to 0.25-mfd.
Inoperative (no plate voltage two '27 second-detector tubes in parallel)	1)	replace 0.5-mfd. condenser from lower end of top plate resistor to ground. Use 400-volt replacement unit

SILVER-MARSHALL RT

Weak reception, Fading, Distortion, Volume control inoperative	1)	partially "shorted" by-pass condenser *C-11* located at resistor terminal strip (connected from ground to one terminal of tone control). Replace with 0.5-mfd. 250-volt unit
Distortion	1)	test '27 AVC tube, or try switching it with the '27 oscillator tube

SILVER-MARSHALL V

Hum	1)	dress dial light leads away from tuning meter leads

SILVER-MARSHALL Z

Inoperative (rectifier tube blown)	1)	check input filter condenser. Replace with 700-volt unit. Also check for "shorted" 0.015-mfd. paper tuning condenser across filter choke. Replace with a 0.01-mfd. and a 0.005-mfd. unit in parallel

SILVER-MARSHALL Z-13

Weak reception, Motorboating sound	1)	check resistor section from screen-grid voltage tap to chassis for "open" or change in resistance. Oscill. plate voltage should be approx. 240 volts

SILVER-MARSHALL A-18

Squealing	1)	check for excessive screen voltage
	2)	try new oscillator tube

SILVER-MARSHALL 30

Inoperative (no screen voltage)	1)	"open" 10,000-ohm rseistor connected to outer terminal of volume control
Inoperative (little or no plate voltages)	1)	"shorted" filter condenser. First check the *green* lead coming from the condenser block
Inoperative, Weak reception	1)	"open" 400-ohm resistor in cathode circuits of 24 r-f tubes
	2)	replace all porcelain resistors
Intermittent reception	1)	check for intermittent "short" between socket prongs due to broken or loose prong springs
Weak reception, Distortion (no C-bias on 45 tubes, and these same tubes drawing heavy plate current)	1)	"open" speaker field coil (this coil also produces the C-bias for the 45 tubes). "Open" will usually be found right at the outside connection of the coil, and may be repaired
	2)	check for increase in value of 3,500-ohm resistor in plate circuit of det. and 1st audio tubes
Noise	1)	if this noise occurs when receiver is heating up, it is likely due to some of the porcelain resistors in the receiver. It is best to replace all of them
Cross-modulation when receiver is used near a powerful local station	1)	replace the first r-f tube with a '27 tube, making the following changes in the circuit: Remove chassis from cabinet and turn receiver upside down. Remove the 400-ohm wire-wound resistor connected to the cathode prong of the 1st r-f tube socket and discard. Remove the 2,600-ohm resistor and *red* condenser wire from the grid terminal of this socket. The screen voltage supply lead to the first r-f stage is clipped off at any con-

(Cont'd)

SILVER-MARSHALL 30—*(Cont'd)*

Cross-modulation when a receiver is used near a powerful local station —*(Cont'd)*		venient point where it will not "short" to the chassis. Connect the *red* condenser lead previously removed, from the grid post to the cathode post. This will connect two of the three sections of the triple 1/10-mfd. condenser to the cathode. Next, remove the grid clip from the wire leading to the antenna choke. Drill a ⅛" hole through the chassis near the 1st r-f stage tube socket. Push the grid wire through this and solder the end of the wire to the grid terminal of the tube socket. Resolder the 2,600-ohm resistor to the cathode and to the chassis
Dial belt will not stay in groove	1)	chip "V" deep enough to allow cable to come flush with surface of pulley. Wrap fine wire around ends of cable and "tin". Also tin the "V" cut on the pulley, then solder cable to ends of "V"

SILVER-MARSHALL 30B

Inoperative (no det. plate voltage)	1)	check, and if necessary, replace the 300,000-ohm detector plate resistor
Crackling noise while tuning	1)	check to see if pilot light socket is "shorting" to chassis intermittently

SILVER-MARSHALL 34

Inoperative	1)	burned out 2-watt bleeder resistor (*R-11*) caused by "shorted" screen-grid by-pass condenser. These by-pass condensers are duo 0.1-mfd. units (two are in *C-6* and one is in *C-7*)
	2)	"open" 25,000-ohm 2-watt resistor *R-9* in first audio plate circuit

SILVER-MARSHALL 36A

Inoperative	1)	"shorted" coupling condenser from 2nd det. plate to grid of '45 power tube. (Check by removing all the tubes except the '80 and test for grid voltage on the 45's)
No control of volume	1)	high-resistance "leak" (even as high as 12-megohms will affect set operation) in 0.1-mfd. condenser by-passing the first r-f and first i-f cathodes. (This condenser is in the triple-unit condenser block)
Intermittent whistling or squealing (insertion of analyzer cable clears up trouble, making testing difficult)	1)	defective r-f choke in series with cathode of first i-f amplifier tube

SILVER-MARSHALL 37, 38, 39

Distortion at low volume on local signals	1)	replace type '24 tube (second from front of set) with a type '35 or '51 tube
	2)	change "minimum" resistor on bakelite strip to 100-ohm unit, grounding one end and connecting the other to the volume control
	3)	connect a 25,000-ohm resistor between the screen of the type '35 tube and the high-voltage side of the volume control

SILVER-MARSHALL 60 (Chassis)

Distortion	1)	replace the 1-megohm grid resistance for 6F5 audio tube with a 0.25-meg. unit

SILVER-MARSHALL 724 (A. C.)

Intermittent reception	1)	check i-f trimmer condensers for intermittent shorting of plates due to shifting of mica insulation
Uncontrollable volume	1)	check 20,000-ohm resistor *R-9* in the screen lead of second i-f tube for a decreased value. Replace with 20,000-ohm 1-watt unit
Distortion (heavy plate current on one '45 tube. Overheating of its bias resistor)	1)	"shorted" 0.1-mfd. coupling condenser to plate side of 1-to-1 audio transformer employed to obtain push-pull action. Use a 600-volt replacement
	2)	check 300,000-ohm grid leak in this stage
Unstable operation at high volume, Whistling or squealing	1)	check plate and screen by-pass condensers
	2)	install a by-pass condenser from a-c line to chassis

SILVER-MARSHALL 782

Same Case Histories as those listed for Silver-Marshall 37, 38, 39 receivers

SILVER MARSHALL 1480

Distortion, Tun-a-lite inoperative, Weak reception	1)	replace Tun-a-lite
	2)	one side of high-voltage secondary open-circuited
Inoperative	1)	1,500-ohm section of voltage divider open-circuited
Hum	1)	two negative sides of condenser block short-circuited internally

---

SILVERTONE

(SEARS ROEBUCK & CO.)

GENERAL SERVICING DATA

Battery operated receivers using 1C6 r-f amp.-mixer going "dead" on low-freq. end of broadcast band	1)	try replacing 1C6 tube
	2)	check resistance of ballast resistor tube to see if it has changed value (this may also be checked by measuring the filament voltages at the tubes, or the filament current). Replace ballast resistor if necessary
Receiver will not track over entire tuning range	1)	try aligning i-f stages a few kc higher or lower than the manufacturer's recommended value
Hum	1)	if receiver uses speaker field as a filter choke, try reversing the leads
	2)	check filter condensers for reduced capacity (or abnormal leakage)
Noisy reception	1)	check for noisy volume control. Replace
Noise control overheats (located at rear of chassis)	1)	"short" in 6A8G tube plate circuit — usually near plate terminal of socket. Replace potentiometer type control

SILVERTONE J

Hum	1)	adjust filament center-tap hum-reducing resistor
	2)	"open" section in filter block
	3)	"open" 0.1-mfd. cartridge-type condensers connected from each side of 26 filament circuit to ground (located adjacent to second and third r-f sockets)

SILVERTONE 36, 37

Weak reception (all tubes and voltages check O.K.)	1)	loosen the set-screws on the rear end of the volume control shaft where the movable primary coil is attached, moving it about ⅛- to ¼-inch into the secondary coils, and tightening the set-screws on the shaft
	2)	replace the type '24 tubes in the r-f section with type '35 tubes
	3)	align trimmers on gang
Whistling or squealing	1)	condenser gang out of alignment

SILVERTONE 41

See also Case Histories listed for Silvertone 36, 37 receivers

Inoperative, Weak reception	1)	"shorted" filter condensers

SILVERTONE 42

No reception between 540 and 950 kc Whistling or squealing	1)	ground one side of the antenna coil to the chassis
	2)	apply an external ground to the chassis
	3)	insert a 25,000-ohm resistor in screen grid lead to 25 det. tube, and by-pass this screen grid to ground with a 0.1-mfd. condenser
Poor reception between 540 and 950 kc (noise and whistles accompanying signals)	1)	ground one side of the antenna coil to the chassis
	2)	connect an external ground to the chassis to reduce hum and improve DX reception
Tunable hum	1)	connect a 0.1-mfd. by-pass condenser from one side of power transformer primary to ground

SILVERTONE 109

Inoperative (no screen-grid voltage)	1)	"shorted" 0.1-mfd. screen by-pass condenser (caused by taut wire connected to power pack resistor strip pulling condenser wall sideways and "shorting" it)
Inoperative (no "B" voltage)	1)	filter choke "shorted" on metal clamping strip that holds bakelite terminal board. Place piece of insulation under bottom of coil
Inoperative (no voltages on r-f tubes)	1)	"open" speaker field (break usually occurs near end)
	2)	"shorted" 1-mfd. r-f plate by-pass condenser
Intermittently inoperative	1)	in early-run receivers, insulation on grid wires running from r-f coils to condenser stators should be checked for "shorting" where they enter shields
Weak reception, Distortion (excessive r-f voltages)	1)	"shorted" speaker field
	2)	check for broken wire in antenna coil primary (primary is wound with a fairly brittle resistance wire). This winding may be replaced with one of copper wire in most cases

(Cont'd over)

SILVERTONE 109—*(Cont'd)*

Whistling or squealing	1)	use an antenna at least 25 feet long
	2)	use good low-resistance ground
	3)	install a pigtail on the tuning condenser rotor
	4)	tighten all "ground" screws throughout chassis
Lack of bass notes	1)	re-center voice coil

SILVERTONE 110

Weak reception, Hum	1)	check 8-mfd. wet electrolytic condenser on top of chassis for low capacity and leakage
Unstable, Whistling or squealing	1)	use an antenna at least 25 feet long
	2)	use good low-resistance ground
	3)	tighten all "ground" screws throughout chassis, also those on gang condenser
	4)	install a pigtail on gang rotor
	5)	replace 9,000-ohm 5-watt carbon resistor (*black* and *red*) and 10,000-ohm 3-watt unit with a 10-watt unit
	6)	connect a 0.002-mfd. condenser from detector plate to grid to reduce r-f component in audio
	7)	reneutralize the receiver
	8)	dress aerial lead-in away from loudspeaker wires
"Roar" and "jingle"	1)	replace the two filament wires and the grid wire to the detector socket with flexible wire
Faulty volume control	1)	to improve control of volume on strong signals, use a 10,000-ohm replacement for the volume control, and connect a 500-ohm 5 or 10-watt resistor in series with the cathode circuit
Lack of bass notes	1)	recenter voice coil

SILVERTONE 111

Unstable, Whistling or squealing	1)	see Case History for this same trouble listed for Silvertone 110 receiver
Faulty volume control	1)	to improve control of volume on strong signals, use a 10,000-ohm replacement for the volume control, and connect a 500-ohm 5 or 10-watt resistor in series with the cathode circuit
Lack of bass notes	1)	recenter voice coil
Hum	1)	poor contact in three electrolytic condensers . Remove the condensers, clean the contacts and put back securely
Microphonics	1)	try several tubes in detector socket
	2)	detector plate voltage should be between 100 and 130 volts. If it is above 200 volts, connect a 50,000-ohm resistor from *green* detector B-plus wire at the detector by-pass condenser to ground
	3)	locate 3 resistors on terminal block under power pack. Replace middle one if its value is off more than 10 per cent from the normal 75,000-ohms

SILVERTONE 111A

Weak reception, Intermittent volume changes	1)	poor or faulty contact at phonograph jack contact points

SILVERTONE 172

Weak reception (all tubes and voltages check O.K.)	1)	loosen set-screw on rear end of volume control shaft (on rear of condenser gang) and move primary coils ⅛ to ¼ inch farther into secondaries. Tighten set-screw. Align trimmers on gang to cut out oscillation. Replace the '24 r-f tubes with '35 tubes

SILVERTONE 550

Inoperative (tubes and voltages test O.K.), Oscillator inoperative unless lead is touched to grid of i-f or second detector tube	1)	connect an 8-mfd. filter condenser from the set side of the filter choke to the common negative return lead on the chassis

SILVERTONE 821

"Hiss" on all stations except strong locals	1)	poor contact at rotor wiper springs. Clean and bend for better tension. Realign set

SILVERTONE 1152

Hum (low control-grid bias on detector)	1)	defect in hum-bucking coil system located in detector grid circuit between cathode and a grounded 0.5-mfd. condenser
Hum	1)	try reversing connections to speaker field

SILVERTONE 1172

Same Case Histories as those listed for Silvertone 36 receiver

SILVERTONE 1174, 1252, 1260

Inoperative, Weak reception, Distortion	1)	"leaky" or "shorted" 0.5-mfd. condenser by-passing 27 det. plate supply
Hum (low control-grid bias on detector)	1)	defect in hum-bucking coil system connected in detector grid circuit between cathode and a grounded 0.5-mfd. condenser
Hum	1)	try reversing connections to speaker field

SILVERTONE 1300

Poor tone, Tone control inoperative	1)	check for poor contact at speaker plug terminals

SILVERTONE 1310, 1312

Inoperative, Weak reception, Distortion, Instability and whistling or squealing	1)	"leaky" or "shorted" by-pass condensers

SILVERTONE 1320, 1322, 1324

Hum	1)	try interchanging '47 output tubes
	2)	check 2,000-ohm resistor in detector cathode circuit
	3)	check 0.5-mfd. condenser in detector cathode circuit
	4)	try reversing speaker field connections
	5)	"open" or "shorted" 20-ohm filament center-tapped resistor

(Cont'd)

SILVERTONE 1320, 1322, 1324—*(Cont'd)*

Wiring diagram	1)	when servicing one of these receivers, if the wiring does not follow the diagram in your service manual, check against the diagram for the Colonial 47, 48 receivers

SILVERTONE 1326

Wiring diagram	1)	when servicing one of these receivers, if the wiring does not follow the diagram in your service manual, check against the diagram for the Colonial 47, 48 receivers

SILVERTONE 1330

Inoperative, Weak reception, Distortion, Instability and whistling or squealing	1)	"leaky" or "shorted" by-pass condensers

SILVERTONE 1386

Wiring diagram	1)	when servicing one of these receivers, if the wiring does not follow the diagram in your service manual, check against the diagram for the Colonial 47, 48 receivers

SILVERTONE 1390, 1400, 1402, 1404, 1406

Inoperative, Weak reception, Distorted signals on powerful locals	1)	check by-pass block mounted in can next to '27 tube. Detector plate by-pass section (0.1-mfd.) is usually at fault. Replace with unit of higher voltage rating
	2)	check 1,000-ohm resistors in plate circuit of same tube for overheated condition

SILVERTONE 1430

Inoperative ("open" or smoking tuning meter)	1)	check *red* wire from condenser block. Replace with 0.1-mfd. 600-volt unit

SILVERTONE 1450

Wiring diagram	1)	when servicing one of these receivers, if the wiring does not follow the diagram in your service manual, check against the diagram for the Colonial 47, 48 receivers

SILVERTONE 1506

No reception	1)	short-circuited 0.01-mfd. by-pass condenser between the plate and grid of the type '47 tube
	2)	"open" i-f transformer primary
	3)	"open" voltage divider
Inoperative or weak above 1200 kc	1)	try a new '24 tube
Volume control acts erratically after replacing faulty second i-f transf.	1)	change volume control circuit by removing all present wires from volume control. Connect center arm to ground. Connect terminal formerly running to ground through 150,000-ohm resistor to cathode of first-detector and i-f stages (including the original resistor in this lead). Connect arm formerly connected to one end of voltage divider to the antenna coil. Ground the end of the divider. Leave screen lead tapped on to the divider (as it was originally)

SILVERTONE 1570

Weak reception	1)	inspect for corrosion around control grid of second detector (where its lead goes through hole in chassis). Slip spaghetti over lead to insulate it from chassis
	2)	substitute any standard 4-lead 175 kc i-f transformer for the resistance-coupled first and second i-f network. Leave 20,000-ohm resistor previously used as a filter with the addition of a 0.1-mfd. paper tubular condenser to by-pass this resistor, or the increased gain is apt to cause motorboating sound
Trouble due to electrolysis	1)	replace the single pole switch with a double-pole single-throw switch, permitting the B-minus lead as well as the A plus to be broken
	2)	change oscillator coil to one using a Bakelite form—or place empire cloth between form and winding
Electrolysis in output transformer	1)	due to chemical contained in paper winding form. Use a Bakelite form when repairing—or place empire cloth between winding and paper form. Preheat and impregnate winding with some moisture-proofing compound

SILVERTONE 1574

Electrolysis in output transformer	1)	due to chemical contained in paper winding form. Use a Bakelite form when repairing—or place empire cloth between winding and paper form. Preheat and impregnate winding with some moisture-proofing compound

SILVERTONE 1580

Weak reception	1)	sensitivity may be improved by replacing the 400-ohm resistor (now in series with the volume control) with a 200-ohm unit

SILVERTONE 1584

Continual blowing of 0.003-mfd., 600-volt condenser connected across power-transformer primary	1)	due to surge built up in primary when line switch is operated. Replace with 800-volt condenser across line side of the on-off switch and the chassis
Weak reception, Hum	1)	connect a 10-mfd. 35-volt condenser from cathode of 58 tube to ground

SILVERTONE 1592

Intermittent distortion	1)	"shorting" speaker field

SILVERTONE 1620, 1622

Ballast lamp burns out	1)	volume control short-circuiting to chassis

SILVERTONE 1640

Undesirable time lag in AVC system, Weak stations interrupted during static bursts	1)	replace the 0.1-mfd. condenser in AVC circuit with 0.01-mfd. unit
Feedback unit, Hiss	1)	insert r-f chokes in the red plate leads of type '283 tube

(Cont'd over)

SILVERTONE 1640—*(Cont'd)*

"Blurping" at high volume levels	1)	reverse transformer secondary leads to grids of type '46 tubes
Motorboating sound	1)	"open" 0.2-mfd. i-f screen by-pass cond.
Reducing hum, Improving tone	1)	replace 0.003-mfd. tone-control condenser unit with a 0.001-mfd. condenser. Replace 100,000-ohm resistor and the 0.1-mfd. condenser in the lead to mid-point of driver tube's grid leak with a 0.5-mfd. condenser from grid leak mid-point to ground. Substitute a 0.003-mfd. condenser for the 0.02-mfd. unit from one leg of the power transformer primary to ground. Replace 8-mfd. 475-volt electrolytic condenser with a 14-mfd. 440-volt unit. In replacing the power transformer, use one with a separate filament winding having a 20-ohm adjustable center-tap resistor across it for one of the 46 driver tubes. The adjustment is quite critical
Volume control does not reduce volume to zero	1)	coupling between second i-f and detector grid leads (under the chassis). Spread these leads as far apart as possible

SILVERTONE 1650, 1652, 1654

Poor selectivity	1)	disconnect the two leads to the small choke in first i-f circuit, and insert in its place a 0.005-mfd. condenser. Now re-align the i-f circuits (this alignment is important)
Poor selectivity in models with 0.005-mfd. condenser in i-f stage	1)	replace second i-f untuned transformer *under chassis* with a 175 kc tuned unit (Part *R6415A*) and re-align both i-f stages. If oscillation should result, reverse connections on plate coil in second i-f stage, being careful not to disturb connections from plate and B-plus to trimmer. The rotor must go to *plus*. (If a Colonial part is not obtainable, use any good 175 kc i-f transformer)

SILVERTONE 1661

Improving outdoor antenna performance (in all chassis other than those identified by *No. 110.414-1*)	1)	add an antenna loading inductance *L-5* (Part *No. 11028112*) in series with loop antenna coil lead now going direct to antenna (*A*) terminal. Also add a 2700-ohm ¼-watt resistor *R-14* in series with other end of this loop antenna winding that now connects direct to antenna (*A*) terminal and to 0.0005-mfd. condenser *C-1*

SILVERTONE 1670

Tunable hum (varies in intensity with the signal)	1)	faulty 56 detector tube. Try interchanging the various 56 tubes in the set until best results are obtained
	2)	a good ground is essential with this receiver to minimize hum

SILVERTONE 1700

Weak reception	1)	the sensitivity may be improved by splicing a piece of wire to the antenna cord supplied with the receiver—or using a regular outside antenna
25Z5 rectifier tube short-lived	1)	overloading of the tube. See that the section of the voltage divider at the negative end is 200 ohms. This will insure sufficient bias on the power tubes for minimum load on the power supply and rectifier tube
Speaker rattle	1)	speaker cone off center. Readjust it

SILVERTONE 1711

Audio "Howl," Microphonics	1)	coil shield on right front of chassis (looking from rear of cabinet) touching a nut which holds the speaker to the front of the grille. Enlarge the chassis bolt holes on the back side of the chassis and "float" the speaker to the front of the chassis on a concentric circle of cardboard
Tube replacements	1)	when changing to standard tube types, replace the 951's with 32's; replace the 950's with 49's

SILVERTONE 1712, 1713

Distortion, Weak reception	1)	with batteries disconnected check with ohmmeter from B minus (*red* and *black* lead) to chassis. If it reads less than 700 ohms there is a "shorted" or partially "shorted" 35-mfd., 20-volt condenser across 700-ohm carbon resistor. (This is found together with two 8-mfd. condensers in a square cardboard box bolted to the chassis)
Fading	1)	corroded band-switch contacts. Clean with sandpaper

SILVERTONE 1721, 1722

Power transformer burns up	1)	inter-element short-circuit in the type '2A3 or '2A3-H tubes
Insensitive on short-wave band	1)	poor antenna installation. Outdoor antenna necessary
	2)	defective type '56 oscillator tube. Substitute other tube
	3)	increase the coupling of the short-wave antenna coils
	4)	re-align the r-f amplifier by tuning in a station at about 6,000-kc, spreading the turns of enameled wire on the coils until maximum volume is secured. *Note*: The trimmer condensers should not be touched in this alignment procedure
Hum	1)	defective type '2A3-H power tubes in push-pull. Substitute others until a hum-balance combination is obtained
Fading, Motorboating sound	1)	replace 4-8 mfd. electrolytic condenser with 8-8 mfd. 450-volt unit
Improving outdoor antenna performance (in all chassis other than those identified by *No. 110.415-2*)	1)	add an antenna loading inductance *L-5* (Part *No. 11028112*) in series with loop antenna coil lead now going direct to antenna (*A*) terminal. Also add a 2700-ohm ¼-watt resistor *R-14* in series with other end of this loop antenna winding that now connects direct to antenna (*A*) terminal and to 0.0005-mfd. condenser *C-1*

SILVERTONE 1732

See also Case Histories listed for Silvertone 1721 receiver

Low volume	1)	increase the screen-grid voltage from 55- to 80-volts by replacing the 15,000-ohm screen-grid resistor with a 10,000-ohm unit

SILVERTONE 1750

Filter condensers blow out, Type 25Z5 tube burns out	1)	short-circuit the 200-ohm fixed resistor in series with the speaker field and ground. Connect a 40-ohm resistor in series with the plate of the '25Z5 tube, connecting to the line cord and eliminating the original connection

SILVERTONE 1760

Inoperative	1)	"shorted" 1-mfd. condenser by-passing second i-f plate supply. Usually the 1,000-ohm resistor in the same circuit needs replacing
Hum (in early-run receivers stamped 206)	1)	replace the 0.1-megohm 0.5-watt resistor in the grid circuit of the 37 a-f tube with one having a value of 1-meg. 0.5-watt. Replace the 20,000-ohm 0.5-watt output tube grid resistor with a 100,000-ohm unit. Replace the 0.02-mfd. 400-volt coupling condenser between the first and second a-f tube with a 0.006-mfd. 400-volt unit

SILVERTONE 1762

Same Case Histories as those listed for Silvertone 1700 receiver

SILVERTONE 1801 A.C.-D.C.

Hum after regular filter replacement	1)	connect the cathodes of the type '25Z5 tube together

SILVERTONE 1802, 1802A, 1803, 1803A

Inoperative	1)	check for "open" 17,000 and 32,000-ohm sections of Candohm voltage divider
Inoperative at high-freq. end of dial	1)	"open" 2-mfd. tubular condenser from oscillator coil to ground
Whistling or squealing	1)	"open" 1-mfd. 160-volt condenser between chassis and high-voltage center-tap of power transformer

SILVERTONE 1807

Inoperative at high-freq. end of dial	1)	"open" 2-mfd. tubular condenser from oscillator coil to ground
Inoperative	1)	check for "open" 17,000 and 32,000-ohm sections of Candohm voltage divider

SILVERTONE 1821

Inoperative	1)	"shorted" 0.1-mfd. second i-f 78 tube plate circuit by-pass condenser. Replace with 600-volt unit. Also check 1,000-ohm ½-watt resistor in same circuit for damage due to overload caused by failure of this condenser

SILVERTONE 1822, 1823

Tuning meter inactive	1)	inspect to see if lock-washers under screws that mount No. 3 and No. 4 short-wave coils to their trimmer condensers "short" to stator plates of these trimmers—or to the movable plate. Clear the lock-washers from these condensers
Speaker rattle	1)	inspect to see if felt ring (Part *No. R9959*) between small speaker and baffle is missing. If so, install one

SILVERTONE 1824

See also Case Histories listed for Silvertone 1822 receiver

Inoperative, Weak reception	1)	check 4-mfd. condenser from 78 screens to ground
	2)	check tuning meter for "open"
	3)	wave-change switch dirty—clean with alcohol

SILVERTONE 1827

See also Case Histories listed for Silvertone 1821 receiver

Abnormal "hiss" on all stations except strong signals	1)	poor contact on rotor wiper springs, clean and bend for better tension. Realign set

SILVERTONE 1829

Weak reception (tuning meter gets hot)	1)	"shorted" 0.1-mfd. condenser in plate circuit of 6A7 tube. Replace meter if it has been damaged (or a 1,000-ohm resistor, connected in the same way as the meter, may be substituted for it)

SILVERTONE 1830

Same Case Histories as listed for Silvertone 1824 receiver

SILVERTONE 1831

Speaker rattle	1)	inspect to see if felt ring (Part *No. R9959*) between small speaker and baffle is missing. If so, install one
Aligning i-f stages	1)	if i-f stages do not align properly at 480 kc, try aligning them at 175 kc or 445 kc

SILVERTONE 1840, 1842

Inoperative (2A5 grids glow bright red)	1)	"open" primary winding in output transformer. Replace transformer, and prevent further recurrence of this trouble by connecting about a 100 or 200-ohm resistor in series with the cathode of the 2A5 tube (to reduce the plate current)

SILVERTONE 1850

See also Case History listed for Silvertone 1862 receiver

Intermittent reception, Weak reception	1)	check the 4½-volt C battery. If it is not up to full value, replace battery
Unsatisfactory control of volume	1)	try increasing normal 1.5-volt bias on 951 tube to about 3 volts

SILVERTONE 1851

Same Case History as that listed for Silvertone 1862 receiver

SILVERTONE 1859-A Auto Radio

6A7 tubes require too frequent replacement	1)	voltage applied to osc. plate is excessive. Reduce by connecting a 15,000-ohm ½-watt resistor in oscillator plate circuit and by-pass this to ground with a 0.1-mfd. 400-volt condenser

SILVERTONE 1862, 1868, 1870

Aligning i-f stages	1)	if i-f stages of these receivers will not align properly at 480 kc, try aligning them at 175 kc

SILVERTONE 1904

Volume cannot be reduced to zero	1)	volume control coil slipping on shaft
	2)	defective type '6C5-G AVC tube (even though it may test O.K.). Substitute other tubes in socket
	3)	leakage between the type '6A7 grid-return lead and the B-plus lead. Isolate the grid return lead from it

(Cont'd over)

SILVERTONE 1904—*(Cont'd)*

Volume cannot be reduced to zero —*(Cont'd)*	4)	shield the fixed coil of the volume control, by fastening a small shield to the mounting screw by means of a nut. With the volume control at minimum setting make adjustments by bending the shield toward, or away from, the coil
Image interference, Whistles	1)	remove wire from broadcast antenna-coil primary to wave-band switch, and run a wire from the outside of the primary winding down through the hole alongside the electrolytic condenser across the top of the chassis down through the power transformer mounting slot to the wave-switch terminal from which the original lead was removed
"Fluttering" on short-wave band	1) 2)	volume control setting too high signal of station too strong *Note*: The above condition may be remedied by connecting an 8-mfd. condenser across the terminal furthest removed from the condenser on the triple terminal board, and the wiper on the dial-end section of the variable condenser (the negative terminal being connected at this point). The leads should be as short and direct as possible

SILVERTONE 1904X

Hiss	1)	check alignment of receiver. If it is O.K., change the 6A7 tube and note the difference
Circuit improvement	1)	these receivers have no bleeder resistor, the 6F6 tube often draws less current after normal life. This causes the voltage to rise too high for safe operation of the filter condensers. To correct this condition, add a 50,000-ohm resistor from 6F6 screen to ground

SILVERTONE 1905

Loose selectivity control shaft	1)	convex washer on shaft should face the back end, otherwise the shaft will work loose

SILVERTONE 1906, 1914

Same Case Histories as listed for Silvertone 1904 receiver

SILVERTONE 1915

Same Case Histories as listed for Silvertone 1905 receiver

SILVERTONE 1918

Sensitivity switch turns when the on-off switch knob is turned	1)	due to a burr in the hollow shaft of the sensitivity switch, causing a tight fit with the on-off shaft inside it. Remove the sensitivity switch hollow shaft and clear away the burr with a piece of emery paper or a round file. This hollow shaft must turn freely on the on-off switch shaft

SILVERTONE 1922A

Inoperative	1)	faulty *blue* lead between condenser block and terminal strip

SILVERTONE 1926

Code interference	1)	re-peak receiver at 445 kc (originally peaked at 480 kc). Re-trim the two padding condensers mounted on gang at 1500 kc. Also re-pad the 600 kc trimmer while rocking selector knob

SILVERTONE 1954

Same Case Histories as listed for Silvertone 1904 receiver

SILVERTONE 1954X

Squealing all over dial	1) 2)	check all condensers and tubes check for high-resistance between chassis and tube shield bases—especially at detector socket. Solder all these bases to the chassis
Hiss	1)	Check alignment of receiver. If it is O.K., try changing the 6A7 tube
Circuit improvement	1)	these receivers have no bleeder resistor, the 6F6 tube often draws less current after normal life. This causes the voltage to rise too high for safe operation of the filter condensers. To correct this condition, add a 50,000-ohm resistor from 6F6 screen to ground

SILVERTONE 1955

Same Case Histories as listed for Silvertone 1905 receiver

SILVERTONE 1964

Same Case Histories as listed for Silvertone 1904 receiver

SILVERTONE 1965

Same Case Histories as listed for Silvertone 1905 receiver

SILVERTONE 1967C (Early Models)

Hum	1)	replace 14-mfd. electrolytic condenser with a 25-mfd. unit
Modulation hum	1) 2) 3)	connect a 75,000-ohm resistor between the screen-grids of the r-f and translator tubes and the B-plus connect a 0.2-mfd. condenser between the r-f and translator tubes to ground replace 20,000-ohm section of voltage-divider with 10,000-ohm 2-watt unit

SILVERTONE 1968

Sensitivity switch turns when the on-off switch knob is turned	1)	due to a burr on hollow shaft of sensitivity switch, causing a tight fit with on-off switch shaft inside it. Remove sensitivity switch hollow shaft and clear away burr with a piece of emery paper on a round file so it turns freely on the on-off switch shaft

SILVERTONE 1986, 1987

Dead receiver	1) 2) 3) 4) 5)	no power at outlet. Check outlet for power. Check contact of power cord plug in outlet defective wave switch contacts. May be caused by stiff leads holding contacts open. Repair or replace *C21* not properly grounded. Tighten "open" or "shorted" part or connection, particularly *C9, C17, C19*. Replace shield cap of 6F5G tube cutting through insulation of grid lead. Repair

(Cont'd)

SILVERTONE 1986, 1987—(*Cont'd*)

Low volume, Insensitive	1)	faulty antenna system. Repair or replace
	2)	receiver out of alignment. Follow alignment procedure specified by mnf'r.
	3)	"open" or "shorted" padder or trimmer. Replace
Whistling or squealing	1)	poor alignment. Follow alignment procedure specified by mn'fr.
	2)	speaker lead too near chassis. Move speaker lead away from chassis
	3)	faulty 6B5 tube. Replace
	4)	change 0.001-mfd. condenser *C22* to a 0.006-mfd. unit
	5)	faulty 6A7 or 78 i-f tube. Replace
	6)	defective condenser *C21*. Replace
	7)	tube shield clamps not making good contact. Clean and tighten
	8)	condenser *C14* "open." Replace
Audio oscillation as volume control is reduced	1)	faulty 6B5 tube. Move shielded grid lead of 6H6G tube between 6H6G and 6B5; or replace 6B5
Whistling or squealing at high-frequency end of band "A"	1)	misplaced lead. Move lead running from band "A" oscillator trimmer to padder
Distortion	1)	caused by oscillation. See "Whistling or Squealing" above
	2)	faulty *C17, C19*. Replace
Hum	1)	line condenser needed. Connect a 0.003-mfd. 800-volt condenser from one side of primary of power transformer to ground
	2)	faulty 6H6G, 6F5G tube. Replace
	3)	faulty electrolytic *C12, C21* condensers. Replace
	4)	*R6* "shorting" to 6A6G heater. Remove "short"
Broad tuning, double peak	1)	faulty 6H6G tube. Replace
Modulation hum (occurs only when a station is tuned in)	1)	connect a 0.01-mfd. 600-volt condenser from the transformer side of the a-c line switch to ground
Code interference	1)	install 262-kc wave trap (Part *No. 1013114477*) in antenna lead. Tune trap by means of adjusting trimmer screw until the interfering signal is eliminated

SILVERTONE 1988, 1989

Weak reception	1)	receiver out of alignment. Realign
Poor tone	1)	too long an antenna being used when receiver is located near powerful station. Shorten antenna or insert a 0.0001-mfd. series condenser
Hum	1)	check 8-mfd. electrolytic filter condenser *C-12* and *C-13* (16-mfd. in 25 cycle receivers)
Audio howl	1)	chassis not floating on rubber cushions. Loosen chassis-mounting screws and remove wooden spacer strips. Be sure shafts or knobs do not touch cabinet
Off calibration	1)	pointer shifted. Re-set pointer
	2)	set not properly aligned. Follow alignment procedure

(Cont'd)

SILVERTONE 1988, 1989—(*Cont'd*)

Whistle at 930 kc (due to a beat between the second harmonic (930 kc) of the 465 kc i-f, and a 930-kc signal)	1)	in localities where the 930 kc station is one that is frequently listened to, it will be desirable to shift the whistle to some other point where it will not be objectionable. This can be done by shifting the i-f frequency of the receiver Determine at what point between 900 kc and 960 kc the whistle will be least objectionable. Dividing this frequency by two will give the new i-f frequency to which the receiver should be aligned. For example, if it is determined that a whistle at 915 kc would not be objectionable, the i-f should be realigned at 915/2 or 457.5 kc Align the i-f at the new frequency, and then realign the rest of the receiver as described in the Service Instructions for this receiver
Code interference	1)	install wave-trap (Part *No. 1013114256*) (which is pre-tuned to i-f of receiver). Adjust wave-trap (by means of trimmer screw at bottom of container) until the interference is eliminated

SILVERTONE 3011

Improving performance of 1st Production receivers	1)	drop the open-end coupling turns used to couple the oscill. tank circuit to the 12SA7-GT tube, using a 0.00005-mfd. mica condenser (*C-12* in schematic circuit diagram) instead
	2)	to make tone more brilliant, change 12SQ7-GT plate by-pass condenser from a 0.0005-mfd. to a 0.00025-mfd. unit (*C-11* in schematic circuit diagram)
	3)	reverse the positions of the two i-f coils, so that the *output* i-f coil is in the shield can and the *input* coil is unshielded. The i-f input coil should be moved to mount on the front chassis flange instead of on top of the chassis base

SILVERTONE 3041

Circuit improvement	1)	add a 0.01-mfd. 400-volt blocking condenser *C-12* in series with ground-return end of antenna transformer primary to increase the impedance between the antenna and the "floating" ground and to satisfy the requirements of the Underwriters Laboratories

SILVERTONE 3111

Same Case Histories as those listed for Silvertone 3011 receiver

SILVERTONE 3141

Same Case Histories as those listed for Silvertone 3041 receiver

SILVERTONE 3211

Same Case Histories as those listed for Silvertone 3011 and Silvertone 7000 receivers

SILVERTONE 3241

Same Case Histories as those listed for Silvertone 3041 receiver

SILVERTONE 3311, 3411, 3511

See also Case Histories listed for Silvertone 3041 receiver

To reduce common coupling	1)	return avc 0.05-mfd. 200-volt by-pass condenser *C-6* to the *chassis base* instead of to "floating" ground

SILVERTONE 3611

Same Case Histories as listed for Silvertone 3011

SILVERTONE 3711

Same Case Histories as listed for Silvertone 7001, 7003

SILVERTONE 3811

Same Case Histories as listed for Silvertone 3011

SILVERTONE 3972

Push-buttons difficult to set accurately on a station	1)	slight burr on the end of the screw insert in the push-button knob. Remove push-button in question and remove the burr that might be on the end of the screw
Removing chassis from cabinet	1)	it is important when reassembling receiver that the selector knob is not pushed on the shaft so far that it will exert pressure on the front of the cabinet, as any friction at this point will cause difficulty in operating the push-buttons

SILVERTONE 4400 Auto Radio

Inoperative	1)	blown fuse
	2)	defective off-on switch
	3)	"open" voice coil or speaker transformer
	4)	defective vibrator, blown condenser, open coil winding. Check "B" voltage
Weak reception	1)	poor antenna system
	2)	receiver not aligned
	3)	speaker field coil "shorted"
	4)	2nd i-f transformer having lost its gain due to the softening of the wax and the shifting of the iron core coupling. Change to new type i-f transf. *No. 107358542* (*No. 8542 on can*)
Poor tone quality	1)	after checking voltages, tubes and vibrator, check 0.02-mfd. condenser in the plate circuit of the 75 tube for "open." speaker cone-off-center
Audio oscillation or howl	1)	possible "open" 0.006-mfd. condenser in plate circuit of 42 tube. Check
	2)	variable condenser not floating freely in its rubber mountings. Free condenser
Whistling or squealing (due to r-f oscillation)	1)	"open" *C-6* by-pass condenser (0.1-mfd. 400-volt unit in B-circuit)
	2)	the grid lead between the mixer tube 6L7 and the variable condenser may be too close to the antenna stage of the variable condenser (top section). Push lead away
Off calibration	1)	check receiver alignment. Realign
	2)	dial hand not set to "maximum" line when condenser is at full capacity. Reset screw on back of drive head
Broad tuning	1)	check alignment, especially the i-f stages
Volume control shaft slips	1)	cable may not be meshed with slot in control shaft due to cable not being far enough in the coupling or volume control bracket may be bending back at an angle which does not allow control to meet shaft slot. Correct as described
Ignition-system noise interference	1)	in some installations, noise interference may be due to the noise being carried into the receiver through the tuning cable. The use of special bracket (*No. 107548637*) will provide a better ground for the tuning cable and noise relief

SILVERTONE 4400-A Auto Radio

Inoperative	1)	blown fuse
	2)	defective on-off switch
	3)	"open" voice coil
	4)	"open" speaker transformer
	5)	defective vibrator; "blown" vibrator condenser; "open" vibrator coil winding. Check "B" voltage
Weak reception	1)	inability to peak i-f transf. may be due to absence of trimmer capacity variation, even though trimmer screw turns. This occurs when the i-f trimmer screw has been turned too tight, causing the plate to become permanently sprung. Change i-f unit
	2)	poor antenna system
	3)	receiver out of alignment. Realign
	4)	speaker field coil "shorted"
Audio oscillation or howl	1)	"open" 0.006-mfd. condenser in plate circuit of 6B5 receiver
	2)	variable condenser not floating freely on its rubber mountings. Free the condenser
Whistling or squealing (due to r-f oscillation)	1)	"open" 0.1-mfd. 400-volt by-pass condenser *C-6* (in B-circuit)
	2)	grid lead between 6L7 mixer tube and variable condenser may be too close to antenna stage of the variable condenser (top section). Push lead away
Poor tone quality	1)	after cheking voltages, tubes, and vibrator, check the 0.02-mfd. condenser in the 75 tube plate circuit for "open"
	2)	speaker cone off center. See that cable wires are not touching cone. Adjust or change speaker
Dial off calibration	1)	set not properly aligned. Realign
	2)	dial hand not set to maximum line when condenser is at full capacity. Reset screw on back of drive head
Broad tuning	1)	check alignment—especially of i-f stages
Volume control cannot be adjusted to minimum	1)	this applies to instrument panel control mounting on certain cars that have the volume control and switch on same knob and is due to the wrong assembly of the drive cable Before connecting drive cable, turn volume control shaft in the set all the way to the *left* and the control knob on the head all the way to the *right*
Vibrator "hash"	1)	due to the exceptional sensitivity of the radio this interference must be kept at a minimum and it is advisable that the cover on the power unit be making good contact to the box. Tighten the cover by bending the flanges inward slightly. Also be sure that the 0.005-mfd. 1600-volt condenser across the vibrator is not "open" It is important that the chassis and power unit make contact to the inside of the receiver case. In addition, it is advisable that the paint be removed from under the various bolt heads on the outside of the case that are holding power unit

SILVERTONE 4401, 4402

Same Case Histories as those listed for Silvertone 1988 receiver

SILVERTONE 4403

Same Case Histories as those listed for Silvertone 1986 receiver

SILVERTONE 4404

Inoperative	1)	broken connection to batteries. Repair
	2)	"dead" batteries. Replace
	3)	defective "on-off" switch (tubes may light but trouble may be in B+ section of switch). Replace
	3)	"shorted" trimmer or padder. Replace
	4)	insulation on wire broken and "shorting" to chassis. Repair
Inoperative on bands "W" and "F" only. (Resistor R-17 burned up)	1)	resistor *R-17* "shorting" to screen prong 1F4 tube. Replace *R-17* and clear "short"
	2)	"shorted" or "open" resistor *R-12*. Repair and replace
Low volume, Insensitive	1)	poor antenna system. Repair or replace
	2)	receiver out of alignment. Follow alignment procedure
	3)	batteries low. Replace
	4)	poor tubes. Replace
	5)	spaghetti-covered lead "shorting" to wave-switch lug
	6)	ground connection of condenser *C-9* broken
	7)	trimmer adjusting screw stripped. Replace
	8)	insulation leakage between primary and secondary of broadcast translator coil *L-4*. This probably will occur only under humid conditions. A test for the condition can be made in the following manner: One end of resistor *R-9*, and one end of resistor *R-6* are connected to separate terminals on the 1N1 socket. Tune in a weak station, preferably on band "W", and "short" these two terminals together on the 1N1 socket. (This put a "short" across resistors *R-6* and *R-9*.) If "shorting" these resistors causes an increase in signal, the translator coil, *L-4* (Part *No. 1012814245*) is faulty and should be replaced
Poor tone	1)	receiver not properly tuned., Explain proper tuning to customer
	2)	overloading of output. Reduce volume control setting
	3)	too high signal input. Shorten antenna or insert 0.00005-mfd. series condenser
Audio howl	1)	chassis not floating on rubber cushions. Wooden spacer strips not removed from under chassis. Loosen chassis-mounting screws and remove wooden spacer strips. Be sure shaft or knobs do not touch cabinet
Off calibration	1)	dial pointer shifted. Re-set dial pointer
	2)	set not properly aligned. Follow alignment procedure
	3)	"open" or "shorted" padder. Replace
	4)	trimmer-adjusting screw stripped
Whistling or squealing	1)	1F4 plate lead too near volume control. Move lead
Whistling or squealing with volume control half way on	1)	speaker leads too near 1B5 tube socket Move leads
Whistling or squealing on band "W"	1)	*blue* and *red* leads from electrolytic misplaced. Move leads under coil mounting bracket
Dial not centered in escutcheon	1)	shifting of escutcheon. Shift escutcheon by pushing with fingers until it is centered around the dial

(Cont'd)

SILVERTONE 4404—*(Cont'd)*

Whistle at 930 kc	1)	a whistle, due to a beat between the second harmonic (930 kc) of the 465 kc i-f and a 930-kc signal may be experienced. In localities where the 930-kc station is one that is frequently listened to, it will be desirable to shift the whistle to some other point where it will not be objectionable. This can be done by shifting the i-f frequency of the receiver Determine at what point between 900 kc and 960 kc the whistle will be least objectionable. Dividing this frequency by two will give the new i-f frequency to which the receiver should be aligned. For example, if it is determined that a whistle at 915 kc would not be objectionable, the i-f should be realigned at 915/2 or 457.5 kc Align the i-f at the new frequency and then realign the rest of the receiver

SILVERTONE 4405

Inoperative	1)	discharged "A" battery. Check and recharge
	2)	poor "A" lead contacts. Clean and tighten
	3)	faulty vibrator. Check B-voltage. Replace if necessary
	4)	insulation on wire broken, and "shorting" to chassis or some other part
Low volume, Insensitive	1)	poor antenna system. Repair or replace
	2)	poor tube. Check all tubes. Replace
	3)	receiver not aligned properly. Follow alignment procedure
	4)	low "A" battery. Check and recharge
	5)	faulty output tube. Replace
Poor tone	1)	receiver not properly tuned. Explain proper tuning to customer
	2)	overloading of output. Reduce volume-control setting
	3)	too high signal input. Shorten antenna or insert 0.00005-mfd. series condenser
	4)	faulty output tube. Replace
Hum	1)	defective electrolytic condenser *C-21*, *C-22*
Audio howl	1)	chassis not floating on rubber cushions. Wooden spacer strips not removed from under chassis. Loosen chassis mounting screws and remove wooden spacer strips. Be sure shaft or knobs do not touch cabinet
Off calibration	1)	pointer shifted. Re-set pointer
	2)	set not properly aligned. Follow alignment procedure
Whistle at 930 kc	1)	a whistle, due to a beat between the second harmonic (930 kc) of the 465 kc i-f, and a 930-kc signal may be experienced. In localities where the 930-kc station is one that is frequently listened to, it will be desirable to shift the whistle to some other point where it will not be objectionable. This can be done by shifting the i-f frequency of the receiver Determine at what point between 900 kc and 960 kc the whistle will be least objectionable. Dividing this frequency by two will give the new i-f frequency to which the receiver should be aligned. For example, if it is determined that a whistle at 915 kc would not be objectionable, the i-f should be realigned at 915/2 or 457.5 kc Align the i-f at the new frequency and then realign the rest of the receiver

SILVERTONE 4406

Same Case Histories as those listed for Silvertone 4404 receiver

SILVERTONE 4407

Same Case Histories as those listed for Silvertone 4405 receiver

SILVERTONE 4408

Same Case Histories as those listed for Silvertone 1989 receiver

SILVERTONE 4409

Inoperative	1)	broken connections to batteries. Repair
	2)	"dead" batteries. Check and replace
	3)	faulty on-off switch. Replace
	4)	"shorted" trimmer or padder
	5)	insulation on wire broken and shorting to chassis or some other part
Weak reception, Insensitive	1)	poor antenna system. Check all connections and repair
	2)	receiver out of alignment. Follow alignment procedure
	3)	batteries "low." Check and replace
	4)	poor tubes. Replace
	5)	trimmer adjusting screw stripped. Replace
Poor tone	1)	receiver not properly tuned. Explain proper tuning to customer
	2)	overloading of output. Reduce volume control setting
	3)	signal input too high. Shorten antenna or insert 0.00025-mfd. or 0.0005-mfd. series condenser
Audio howl	1)	three screws under chassis shelf not loosened. Loosen screws
Off calibration	1)	dial pointer shifted. Re-set dial pointer
	2)	set not properly aligned. Follow alignment procedure
	3)	trimmer adjusting screw stripped. Replace
Dial not centered in escutcheon	1)	shifting of escutcheon. Shift escutcheon by pushing with fingers until it is centered around the dial
Code interference	1)	install wave-trap *No. 1013114256*
Whistle at 930 kc	1)	a whistle, due to a beat between the second harmonic (930 kc) of the 465 kc i-f, and a 930-kc signal may be experienced. In localities where the 930-kc station is one that is frequently listened to, it will be desirable to shift the whistle to some other point where it will not be objectionable. This can be done by shifting the i-f frequency of the receiver Determine at what point between 900 kc and 960 kc the whistle will be least objectionable Dividing this frequency by two will give the new i-f frequency to which the receiver should be aligned. For example, if it is determined that a whistle at 915 kc would not be objectionable, the i-f should be realigned at 915/2 or 457.5 kc Align the i-f at the new frequency, and then realign the rest of the receiver

SILVERTONE 4410, 4411

Same Case Histories as those listed for Silvertone 4404 receiver

SILVERTONE 4413

Same Case Histories as those listed for Silvertone 4409 receiver

SILVERTONE 4414, 4415

Inoperative	1)	no current at outlet. Check outlet for current and be sure power cord plug is making good contact
	2)	defective "on-off" switch. Replace
Weak reception, Insensitive	1)	insufficient antenna pick-up. Connect to outdoor antenna
	2)	defective tube. Replace
	3)	receiver out of alignment. Follow alignment procedure
Station interference	1)	receiver located near powerful stations. Do not uncoil all of the antenna
Poor tone	1)	overloading. Reduce volume control setting
	2)	speaker out of adjustment. Replace or repair
Hum	1)	defective electrolytic condensers *C-4, C-10* or *C-12*
	2)	try reversing power plug
Whistling or squealing	1)	antenna lead coiled around or near set. Run antenna wire away from the set
Cautions to be observed when servicing receiver	1)	all of the tubes, except the 1V, are connected in series. Accordingly, if any one tube burns out the other will not light. It is necessary to replace only the burned out tube; the others will then light
	2)	an auto-transformer is used, instead of the usual power transformer having separate primary and secondary windings. For this reason, under certain conditions the chassis may be 115 volts above ground potential
	3)	for the reason stated in the previous paragraph, care must be taken not to allow any grounded object to come in contact with the chassis while it is plugged into the line. The chassis is insulated from the metal bottom cover of the cabinet by means of rubber grommets

SILVERTONE 4416

Inoperative	1)	defective "on-off" switch. Replace
	2)	"open" or "short" in set. Repair or replace part affected
Weak reception, Poor sensitivity	1)	insufficient antenna pick-up. Connect to outdoor antenna
	2)	defective tube. Replace
	3)	receiver out of alignment. Follow alignment procedure
Station interference	1)	receiver located near powerful stations. Do not uncoil all of the antenna
Poor tone	1)	overloading. Reduce volume control setting
	2)	speaker out of adjustment. Replace or repair
Hum	1)	defective electrolytic condenser *C-4, C-10 or C-12*
	2)	try reversing the power plug
Whistling or squealing	1)	antenna lead coiled around or near set. Run antenna wire away from the set

(Cont'd)

SILVERTONE 4416—(*Cont'd*)

Cautions to be observed when servicing receiver	1)	all of the tubes, except the 1V, are connected in series. Accordingly, if any one tube burns out, the others will not light. It is necessary to replace only the burned out tube; the others then will light. The burned out tube (except the 1V) can be determined through the fact that the full filament voltage (approximately 50 volts) will appear across its filament prongs. For this reason, care must be taken when testing to use a high enough scale of the meter to prevent damage to the meter. The 1V tube will show only 6 volts across its filament prongs even when it is burned out because it is connected across a 6-volt tap on the transformer
	2)	an auto-transformer is used, instead of the usual power transformer having separate primary and secondary windings. For this reason, under certain conditions the chassis may be 115 volts above ground potential
	3)	for the reason stated in the previous paragraph, care must be taken not to allow any grounded object to come in contact with the chassis while it is plugged into the line

SILVERTONE 4419

Inoperative	1)	poor connection to "A" battery. Repair
	2)	discharged "A" battery. Recharge
	3)	defective "on-off" switch. Replace
	4)	defective vibrator. Replace
	5)	insulation on wire broken and "shorting" to chassis. Repair
	6)	"open" or "short" in some part. Locate defective part by means of voltage or continuity tests. Repair or replace
Weak reception, Poor sensitivity	1)	poor antenna system. Repair or replace
	2)	receiver out of alignment. Follow alignment procedure
	3)	"A" battery low. Recharge
Inoperative at 2 mc. on band "P"	1)	in original production receivers the 50,000-ohm resistor, *R-3*, was connected to ground. In later production chassis, rubber stamped with the letter "A", or a subsequent letter, the resistor connection was made to the cathode of the 6D8G tube. This prevents failure to oscillate at 2 mc on the Police Band with certain 6D8G tubes. Trouble of this sort in the field with earlier production receivers can be corrected by changing the oscillator tube or preferably by changing the connection of *R-3* to the cathode of the 6D8G tube
"Hash" from vibrator	1)	power supply housing screws not tight enough. Securely tighten all screws in power supply housing
Audio howl	1)	chassis not floating on rubber cushions. Wooden spacer strips not removed from under chassis. Loosen chassis mounting screws and remove wooden spacer strips. Be sure shaft or knobs do not touch cabinet
Poor tone	1)	receiver not properly tuned. Explain proper tuning to customer
	2)	overloading of output. Reduce volume control setting
	3)	too high signal input. Shorten antenna, or insert 0.00005-mfd. series condenser
Dial not centered in escutcheon	1)	shifting of escutcheon. Shift escutcheon by pushing with fingers until it is centered around the dial

(Cont'd)

SILVERTONE 4419—(*Cont'd*)

Code interference	1)	install wave-trap *No. 1013114256* and adjust

SILVERTONE 4420

Same Case Histories as those listed for Silvertone 1989 receiver

SILVERTONE 4421

Same Case Histories as those listed for Silvertone 2521 receiver

SILVERTONE 4422, 4423

Same Case Histories as those listed for Silvertone 4409 receiver

Audio howl, Whistling or squealing	1)	*yellow* volume control lead misplaced. Move lead
	2)	1B5 tube shield missing. Replace

SILVERTONE 4424

Same Case Histories as those listed for Silvertone 4404 receiver

SILVERTONE 4425

Same Case Histories as those listed for Silvertone 4404 receiver

SILVERTONE 4426, 4426A, 4427

See also Case Histories listed for Silvertone 4409 receiver

Weak reception	1)	check for high-resistance leak in wave-band switch—affecting avc on r-f stage
Audio howl	1)	microphonic 1B5, 1F6, or 230 tube. Replace
Whistling or squealing with tone control set at "Treble," and volume control three-quarters way on	1)	improper positioning of *yellow* and *green* volume control leads. Move leads

SILVERTONE 4428

Same Case Histories as those listed for Silvertone 4405 receiver

SILVERTONE 4428A

See also Case Histories listed for Silvertone 4405 receiver

Whistling or squealing (all over dial)	1)	speaker leads near 6Q7G tube grid lead (if unshielded type grid lead). Move speaker leads
Whistling or squealing at high-freq. end of foreign band	1)	in all chassis rubber-stamped with the letter "*D*" (or subsequent letter) on the chassis identification sticker, the proper change has already been made in the receiver to prevent this trouble. On all earlier runs of receivers, change the value of the oscillator grid leak *R-4* from 50,000-ohms to 25,000 ohms
Motorboating sound	1)	6C7G and 6D8G grid leads from variable condenser too close together. Move these leads apart

SILVERTONE 4429 (32-Volt receiver)

Inoperative
1) no power. Check outlet for power. Check contact of power cord plug in receptacle
2) polarity reversed. Reverse plug. These models are to be operated from a 32-volt DC supply source only. The power supply cord plug must be inserted in its receptable correctly. If, after waiting a full minute with the receiver turned on, there is no sound from the speaker, turn the power cord plug half way around and re-insert it in its receptable. When the correct position has been determined, as just described, mark the plug with a notch or by a similar method so that the plug can be correctly re-inserted should it be removed from its receptacle for any reason. No vibrator or generator is used, the 32-volt supply being applied directly to the tube elements
3) defective "on-off" switch. Replace
4) "open" or "shorted" part or connection in receiver. Test by means of continuity or voltage tests. Repair or replace

Weak reception, Poor sensitivity
1) faulty antenna system. Repair or replace
2) receiver out of alignment. Follow alignment procedure
3) lighting-system voltage low. Recharge batteries

Poor tone
1) receiver not properly tuned. Explain proper tuning to customer
2) overloading of output. Reduce volume-control setting
3) too high signal input. Shorten antenna, or insert 0.00005-mfd. series condenser
4) poor 75 or 48 tubes. Replace

Audio howl,
1) chassis not floating on rubber cushions. Wooden spacer strips not removed from under chassis. Loosen chassis mounting screws and remove wooden spacer strips. Be sure shafts or knobs do not touch cabinet
2) *blue* leads to speaker socket misplaced. Move leads
3) plate leads of the 48 tube misplaced. Move leads
4) defective 6A7 tube. Replace

Off calibration
1) dial pointer shifted. Re-set dial pointer
2) "open" or "shorted" padder or trimmer. Replace
3) trimmer adjusting screw stripped. Replace
4) set not properly aligned. Follow alignment procedure

Dial not centered in escutcheon
1) shifting of escutcheon. Shift escutcheon by pushing with fingers until it is centered around the dial

Noisy variable condenser
1) wiper fingers making poor contact. Clean and tighten fingers
2) "shorting" or "dirty" plates. Clean and repair

Dial light replacement
1) the dial light is shunted by the 100-ohm resistor, *R-7*, and the combination is in series with the speaker field. Accordingly, when replacement of the dial lamp becomes necessary the proper type should be inserted to insure proper brilliancy and to insure proper speaker field current. The part number of the correct lamp is *101492288*

SILVERTONE 4434

Same Case Histories as those listed for Silvertone 4521 receiver

SILVERTONE 4442, 4443

Same Case Histories as those listed for Silvertone 4409 receiver

SILVERTONE 4444, 4445

Same Case Histories as those listed for Silvertone 4404 receiver

SILVERTONE 4446, 4447

Same Case Histories as those listed for Silvertone 4426 receiver

SILVERTONE 4448

Same Case Histories as those listed for Silvertone 4405 receiver

SILVERTONE 4448A

Same Case Histories as those listed for Silvertone 4428A receiver

SILVERTONE 4449

Same Case Histories as those listed for Silvertone 4429 receiver

SILVERTONE 4450

Same Case Histories as those listed for Silvertone 4550 receiver

SILVERTONE 4459

Same Case Histories as those listed for Silvertone 4419 receiver

SILVERTONE 4461, 4462

Same Case Histories as those listed for Silvertone 1988 receiver

SILVERTONE 4463, 4464

Same Case Histories as those listed for Silvertone 1986 receiver

SILVERTONE 4465

Inoperative
1) no power. Check outlet for power. Check contact of power cord plug in receptacle
2) defective "on-off" switch. Repair or replace
3) "open" or "shorted" part or connection in the receiver. Test by means of continuity or voltage tests. Repair or replace
4) 6Q7G grid clip off (due to stiff lead). Replace clip on 6Q7G cap
5) "shorted" trimmer or padder. Replace

Inoperative, Weak (on all three bands)
1) check tube and voltages
2) "short" between the coupling turn and the secondary of the Police band r-f coil *L-5*. The short may first cause crankling and sputtering; later the set will stop playing
To test for this "short," disconnect the *red* and *yellow* wires from the coil (*L-5*) and test for continuity from either end of the trimmer condenser on the coil to the lug to which the coil coupling turn is connected. This should show an open circuit. Even the slightest leakage between these two points with the *red* and *yellow* wires disconnected, calls for the replacement of the coil (which is part *No. 1002888604*)

(Cont'd)

SILVERTONE 4465—(*Cont'd*)

Weak reception, low sensitivity	1)	faulty antenna system. Repair or replace
	2)	receiver out of alignment. Follow alignment procedure
	3)	"open" or "shorted" part or connection. Test by means of continuity or voltage tests. Repair or replace
	4)	trimmer adjusting screw stripped. Replace
Poor tone	1)	one megohm resistor on 6G5 socket touching lug. Correct "short"
	2)	receiver out of alignment. Follow alignment procedure
	3)	oscillation. See *"Whistling or squealing,"* below
	4)	speaker mounting not free. In later production, the speaker of Console Models was mounted on felt cushions instead of being screwed directly to the baffle. For shipping purposes, this cushion mounting is made rigid by screwing the two wooden strips (that hold the felt cushions) tightly to the baffle. To secure the advantage of the felt cushions and to insure best tone, the screw at each end of the two wooden ships should be loosened about one turn, allowing the speaker to have a non-rigid mounting
Whistling or squealing	1)	*yellow* volume control lead too near 6N6G plate. Move lead away
	2)	defective 6K7G r-f tube. Replace
	3)	defective 6C5G tube (oscillation on band "F"). Replace, and realign receiver
	4)	*R-1, R-2* "shorting" to bottom coil shield. Correct "short"
Tuning eye not working	1)	defective tube. Replace. Do not tighten clamp too much. The clamp that mounts the 6G5 tuning eye tube must not be tightened too much. Sometimes, tightening this clamp too much causes a minute crack in the tube, spoiling the vacuum and interfering with its proper operation
	2)	"shorted" or "open" *R-12*. Repair or replace
Hum	1)	defective 6Q7G tube. Replace
	2)	C-23 too near "on-off" switch. Move *C-23* away from switch
	3)	defective electrolytic condenser *C-27, C-28*. Replace
Motorboating sound on band "F"	1)	defective 6K7G tube. Replace one or both
Improper wave switch action	1)	defective contact. Repair or replace
	2)	loose set-screw on gear sector. Re-set and tighten set-screw
Off calibration	1)	use of shielded 6C5G tube. There are two types of 6C5G tubes, one shielded and the other unshielded. They can be told apart easily by appearance. The shielded type has a perforated mesh screen surrounding the other elements. This screen is about an inch in diameter and comes very close to the inside of the bulb. The unshielded type does not have this perforated mesh screen. The plate of the tube, of solid metal and about ⅝" diameter, is visible. It is important that only the unshielded type 6G5G (*without the perforated mesh screen*) be used in the oscillator socket. Use of the shielded type will upset band "F" calibration and interfere with proper performance
	2)	dial pointer slipped. Re-set pointer
	3)	defective padder or trimmer. Replace

(Cont'd)

SILVERTONE 4465—(*Cont'd*)

Noisy variable tuning condenser	1)	wiper fingers making poor contact. Clean and tighten fingers
	2)	"shorting" or "dirty" plates. Repair
Correct connection of 6G5 tuning eye cathode	1)	if volume increases when 6G5 tube is removed from its socket, examine the *slate* colored cathode lead of the 6G5. If it is connected to cathode of 6N6G tube, it should be removed from there and connected instead to the 6G7G cathode
Code interference	1)	install wave trap (Part *No. 1013115433*) and adjust if necessary
Whistle at 930 kc	1)	a whistle, due to a beat between the second harmonic (930 kc) of the 465-kc i-f, and a 930-kc signal may be experienced. In localities where the 930 kc station is one that is frequently listened to, it will be desirable to shift the whistle to some other point where it will not be objectionable. This can be done by shifting the i-f frequency of the receiver Determine at what point between 900 kc and 960 kc the whistle will be least objectionable. Dividing this frequency by two will give the new i-f frequency to which the receiver should be aligned. For example, if it is determined that a whistle at 915 kc would not be objectionable, the i-f should be realigned at 915/2 or 457.5 kc Align the i-f at the new frequency and then realign the rest of the receiver

SILVERTONE 4466, 4467

Inoperative	1)	no a-c power supply. Check receptacle
	2)	grid cap "shorted" by cap of shield. Check shield cap
	3)	"shorted" by-pass condenser. Check parts by means of continuity meter and voltage checks, and replace
	4)	"shorted" filter condenser
	5)	defective tube. Replace
Weak reception	1)	insufficient antenna. Repair antenna system
	2)	defective tube
	3)	"leaky" filter condenser. Replace
	4)	broken antenna return on coil. Check with continuity meter
	5)	radio out of alignment. Re-align
	6)	"open" filter. Replace
Poor tone	1)	poor tubes. Check tubes
	2)	"open" filter condenser
	3)	receiver out of alignment. Re-align
	4)	spkr. cone off center. Recenter cone
Whistling or squealing	1)	poor contact of tube shield
	2)	defective tubes. Check tubes
	3)	"open" by-pass condenser. Replace defective units
	4)	poor chassis grounds. Check ground connections
	5)	receiver out of alignment. Re-align receiver
Fading	1)	defective tubes. Replace
	2)	loose connections. Solder loose connections
	3)	antenna defective. Check aerial system
Hum	1)	"open" filter condenser. Replace defective units
	2)	defective tube. Replace
	3)	defective bias. Check

(Cont'd over)

SILVERTONE 4466, 4467—(*Cont'd*)

Calibration off	1) dial pointer shifted. Reset dial pointer 2) receiver out of alignment. Re-align receiver
Howl	1) microphonic tube. Replace tube 2) dial shaft touching cabinet. Readjust chassis in cabinet 3) dial touching cabinet. Readjust chassis in cabinet 4) gang condenser too tight. Loosen mounting of gang

SILVERTONE 4468

Inoperative	1) no power at outlet. Check outlet for power. Check contact of power cord plug in outlet 2) defective wave switch contacts. May be caused by stiff leads holding contacts open. Repair or replace 3) "open" or "shorted" part or connection. Check by means of voltage or continuity tests. Repair or replace
Weak reception	1) faulty antenna system. Repair or replace 2) receiver out of alignment. Follow alignment procedure 3) "open" or "shorted" padder or trimmer. Replace
Whistling or squealing	1) poor alignment. Follow alignment procedure 2) speaker lead too near chassis. Move speaker lead away from chassis 3) tube shield clamps not making good contact. Clean and tighten 4) "open" condenser *C-13*. Replace 5) "shorted" resistor *R-9*. Repair or replace
Whistling or squealing at high-frequency end of band "A"	1) misplaced lead. Move lead running from band "A" oscillator trimmer to padder
Distortion	1) caused by oscillation. See "Whistling or squealing," above 2) faulty *C-17*, *C-18*, *C-19* condensers. Replace
Hum	1) faulty electrolytic condenser *C-15*, *C-22*. Replace
Tuning eye not working	1) faulty 6H5 tube. Replace 2) "shorted" resistor *R-6*. Replace or replace

SILVERTONE 4469

Same Case Histories as those listed for Silvertone 4466 receiver

SILVERTONE 4470

Same Case Histories as those listed for Silvertone 4468 receivers

SILVERTONE 4472, 4473

Inoperative	1) broken connection to batteries. Repair 2) "dead" batteries or tubes. Replace 3) defective "on-off" switch. Replace 4) "open" or "short" in some part. Locate defective part and replace

(Cont'd)

SILVERTONE 4472, 4473—(*Cont'd*)

Weak reception	1) poor antenna system. Check all connections, and repair 2) receiver out of alignment. Follow alignment procedure 3) batteries low. Replace 4) poor tubes. Replace
Poor tone	1) receiver not properly tuned. Explain proper tuning to customer 2) overloading of output. Reduce volume control setting 3) too high signal input. Shorten antenna or insert 0.00005-mfd. series condenser
Audio howl	1) three screws under chassis shelf not loosened. Loosen screws 2) misplaced leads. Move *red* B+ lead running from 1F5G screen to switch away from bias cell. Speaker leads must be close against side of chassis
Off calibration	1) dial pointer shifted. Re-set dial pointer 2) set not properly aligned. Follow alignment procedure
Distortion when receiver is on test bench (O.K. when back in cabinet)	1) the bias cell for the 1F7G tube. When the receiver is in its normal position the bias cell will be mounted on its side which is the correct position so that the liquid will come into contact with the carbon block and the inside of the metal container. However, the receiver may be stood on its end when working on it on the service bench. In this position the bias cell may be upright and the liquid may not touch the carbon block. If this happens, it will cause severe distortion. Accordingly, the necessary precautions should be observed when working on the receiver on the service bench

SILVERTONE 4484

Same Case Histories as those listed for Silvertone 1986 receiver

SILVERTONE 4485

Same Case Histories as those listed for Silvertone 4465 receivers

SILVERTONE 4486

Inoperative on all bands	1) no power at a-c outlet. Check or repair a-c power source 2) "shorted" by-pass condenser 3) burned out power transformer. Determine defective parts by means of continuity and voltage tests, and replace 4) defective tubes 5) "open" coupling condenser 6) "shorted" filter condenser 7) "open" plate resistor 8) high-resistance short between coupling turn (primary circuit) and secondary of Police band r-f coil (*L-5*). Replace coil
Weak reception, Insensitive, Tuning eye does not close sufficiently	1) inadequate antenna. Replace antenna system 2) defective tubes 3) "leaky" filter condenser. Replace 4) "leaky" by-pass condenser 5) high-resistance "short" between coupling turn (primary circuit) and secondary of Police band r-f coil (*L-5*). Replace coil

(Cont'

SILVERTONE 4486—(*Cont'd*)

Poor tone
1) defective tubes
2) "leaky" by-pass condenser. Replace
3) "open" filter condenser
4) speaker cone off-center. Recenter speaker cone
5) receiver out of alignment. Realign receiver

Whistling or squealing
1) defective tubes
2) "open" by-pass condenser. Replace
3) poor contact of tube shield
4) receiver out of alignment. Realign receiver
5) poor chassis grounds. Check ground connections in chassis

Fading
1) defective tubes. Replace
2) defective audio coupling condenser. Replace
3) loose connections. Resolder loose connections
4) defective antenna system. Check and repair antenna

Hum
1) "open" filter condenser
2) defective by-pass condenser. Replace
3) "shorted" heater type tube

Tuning dial off calibration
1) dial pointer shifted. Set dial pointer
2) receiver out of alignment. Realign receiver

Audio howl
1) shipping blocks not removed. Remove wood shipping blocks
2) knob shafts in contact with cabinet. Readjust chassis in cabinet
3) microphonic tubes. Replace

Microphonics or howl on short-wave band
1) first make careful test of all tubes, eliminating those which are microphonic, and other parts which might cause howl if defective. A good ground must be used. It is also advisable to see that the control knobs are not jammed too tightly against the cabinet front. If microphonics or howl is not caused by defective parts or any of the above items, it can usually be eliminated or greatly reduced by making the following circuit changes:
   (a) disconnect and remove the 110,000-ohm, ¼-watt carbon resistor which is connected from the junction of the 510,000-ohm grid resistors in the grid circuits of the output stage, to the center-tap of the power transformer. This resistor will be found only in receivers carrying changes shown in supplement No. 1 of bulletin 57 RL 26. In receivers where this resistor is not present, the lead between the junction of the two grid resistors and the center tap should be removed. The junction point referred to should then be connected to ground
   (*b*) short out the *R-18A* section of the Candohm bias-resistor strip
   (*c*) open the cathode connections to ground on both of the 6F6 output tubes. Then connect the two cathode terminals, of the 6F6 output tubes, together. Finally, from the cathode terminal, of either of the 6F6 output tubes connect a 270-ohm 2-watt resistor to ground. *The value given for this resistor is quite critical.* (This resistor is obtainable from Stewart-Warner under part *No. 10021110644*)

SILVERTONE 4487

Station other than chosen AFC station is received
1) the following condition sometimes occurs. Normally, a station that has been set up on the toothed disc will be heard whenever the dial pointer is turned to its call letters. It sometimes happens though that the station will only be heard if it is approached from one end of the dial but an adjacent station will be heard if approached from the other end of the dial. This is due to the fact that the proper tooth was not selected carefully enough for the station, and an adjacent tooth was bent up instead. The remedy is to put the receiver in the "sharp" position, tune in the desired station very carefully, and to be sure to bend up the tooth that is under the projection of the contacting arm

Slipping dial drive
1) movable arm set too close to toothed disc. The arm will then press unnecessarily hard against the bent up teeth, making the condenser too hard to turn. If this appears to be the case, the adjusting screw on the movable arm should be loosened and the arm re-set so it doesn't press too hard against the teeth

SILVERTONE 4488, 4488A

Inoperative
1) no power. Check outlet for power. Check contact of power cord plug in receptacle
2) defective "on-off" switch. Repair or replace
3) trimmer adjusting screw stripped

Weak reception
1) faulty antenna system. Repair or replace
2) receiver out of alignment. Follow alignment procedure
3) "open" or "shorted" part or connection. Test by means of continuity or voltage tests. Repair or replace
4) trimmer adjusting screw stripped. Replace

Hum
1) defective electrolytic condenser *C-48, C-50, C-51.* Replace

Audio howl
1) chassis not floating on rubber cushions. Wooden spacer strips not removed from under chassis. Loosen chassis mounting screws and remove wooden spacer strips. Be sure shafts or knobs do not touch cabinet
2) failure to cut the two pieces of tape, used for shipping, that are tied from the dial housing to the back of the cabinet. Remove tape
3) microphonic 6R7G tube. Replace

Improper wave switch action
1) defective contact. Repair or replace
2) set-screw in gear sector loosened. Reset sector and tighten set-screw

Tuning dial off calibration
1) use shielded type 6C5G oscillator tube
2) dial pointer slipped. Re-set pointer
3) defective padder or trimmer. Replace
4) receiver out of alignment

Noisy variable tuning condenser
1) wiper fingers making poor contact. Clean and tighten fingers
2) "shorting" or dirty plates. Repair

Flash-tuning light remains on
1) faulty flash-tuning relay contacts. See manufacturer's instructions for testing and adjusting them
2) "open" or "shorted" relay coil

Set not silent between flash stations
1) faulty 6R7G tube. Replace

SILVERTONE 4490

Same Case Histories as those listed for Silvertone 4468 receiver

SILVERTONE 4498, 4499

Same Case Histories as those listed for Silvertone 4472 receiver (with exception of note on Audio Oscillation)

SILVERTONE 4500

Same Case Histories as those listed for Silvertone 4414 receiver

SILVERTONE 4501

Inoperative	1)	no current at outlet. Check outlet for current and be sure power cord plug is making good contact
	2)	defective "on-off" switch. Replace
	3)	"open" or "short" in set. Repair and replace
Weak reception	1)	insufficient antenna pick-up. Connect to outdoor antenna
	2)	defective tube. Replace
	3)	receiver out of alignment. Follow alignment procedure
Station interference	1)	receiver located near powerful stations. Do not uncoil all of the antenna
Poor tone	1)	overloading. Reduce volume control setting
	2)	speaker out of adjustment. Repair or replace
Hum	1)	defective electrolytic condenser *C-4, C-10,, C-12.* Replace
	2)	try reversing power plug
Whistling or squealing	1)	antenna lead coiled around or near set Run antenna wires away from the set

SILVERTONE 4502

Inoperative	1)	"open" line cord
	2)	defective on-off switch
Hum	1)	if operated on A-C try reversing power plug
	2)	AC-DC switch not in proper position. Put switch in the correct position (this is accessible from bottom of cabinet and operated with a screw-driver)
	3)	faulty electrolytic condensers *C-6, C-8, C-13 or C-15.* Replace
Whistling or squealing	1)	antenna lead coiled around or near set. Run antenna wire away from the set

SILVERTONE 4503

Same Case Histories as those listed for Silvertone 4501 receiver

SILVERTONE 4504

Same Case Histories as those listed for Silvertone 4502 receiver

SILVERTONE 4505, 4506

Same Case Histories as those listed for Silvertone 4414 receiver

SILVERTONE 4507

Same Case Histories as those listed for Silvertone 4501 receiver

SILVERTONE 4508

Same Case Histories as those listed for Silvertone 4502 receiver

SILVERTONE 4519

Same Case Histories as those listed for Silvertone 4419 receiver

SILVERTONE 4520

Same Case Histories as those listed for Silvertone 1989 receiver

SILVERTONE 4521

Inoperative	1)	no 6-volts power supply. Check storage battery
	2)	grid cap "shorted" by cap of shield
	3)	"shorted" by-pass ccondenser
	4)	"open" choke (B filter)
	5)	"open" choke (r-f in power pack)
	6)	vibrator sticking. Replace vibrator
Weak reception	1)	insufficient antenna
	2)	low "A" volts. Check storage battery
	3)	defective tube
	4)	"leaky" filter condenser
	5)	broken antenna return on coil. Check with continuity meter
	6)	radio out of alignment. Re-align
	7)	"open" filter
Poor tone	1)	low "A" battery. Check storage battery
	2)	poor tubes. Check tubes
	3)	"open" filter condenser
	4)	receiver out of alignment. Re-align
	5)	Spk'r cone off center. Recenter cone
Whistling or squealing	1)	poor contact of tube shield
	2)	defective tubes. Check 6S7-G tube
	3)	"open" by-pass condenser. Replace defective units
	4)	poor chassis grounds. Check all ground connections
	5)	receiver out of alignment. Re-align receiver
Fading	1)	defective tubes. Replace
	2)	loose connections. Solder loose connections
	3)	antenna defective. Check antenna system
Hum	1)	"open" filter condenser. Replace defective units
	2)	"shorted" filter choke
	3)	defective tube. Replace tube
	4)	defective vibrator. Replace vibrator
Dial off calibration	1)	dial pointer shifted. Reset dial pointer
	2)	receiver out of alignment. Re-align receiver
Howling	1)	microphonic tube. Replace tube
	2)	dial shaft touching cabinet. Readjus chassis in cabinet
	4)	gang condenser too tight. Loosen mounting of gang

SILVERTONE 4522, 4523

Same Case Histories as those listed for Silvertone 4409 receiver

SILVERTONE 4524

Same Case Histories as those listed for Silvertone 4404 receiver

SILVERTONE 4524A

Same Case Histories as those listed for Silvertone 4422 receiver

SILVERTONE 4526, 4526A

Same Case Histories as those listed for Silvertone 4426 receiver

SILVERTONE 4528A

Same Case Histories as those listed for Silvertone 4428A receiver

SILVERTONE 4529

Same Case Histories as those listed for Silvertone 4429 receiver

SILVERTONE 4532

Same Case Histories as those listed for Silvertone 4422 receiver

SILVERTONE 4533

Same Case Histories as those listed for Silvertone 4472 receiver

SILVERTONE 4542, 4543

Same Case Histories as those listed for Silvertone 4409 receiver

SILVERTONE 4542A

See also Case Histories listed for Silvertone 4422 receiver

Inoperative on low-frequency end of broadcast band	1) if oscillator is "dead" at these frequencies, remove the 50-mmfd. mica condenser connected between 1C6 mixer and band switch. Connect these two points together directly. Also remove 50,000-ohm resistor from same terminal on tube socket and connect across low-frequency padder

SILVERTONE 4544

Same Case Histories as those listed for Silvertone 4404 receiver

SILVERTONE 4546, 4546A

Same Case Histories as those listed for Silvertone 4426 receiver

SILVERTONE 4548

Same Case Histories as those listed for Silvertone 4405 receiver

SILVERTONE 4548A

Same Case Histories as those listed for Silvertone 4428A receiver

SILVERTONE 4549

Same Case Histories as those listed for Silvertone 4429 receiver

SILVERTONE 4550

Inoperative	1) discharged "A" battery. Recharge 2) poor "A" lead contacts. Clean and tighten 3) defective vibrator. Replace 4) "open" or "short" in some part. Test by means of voltage readings or continuity tests. Repair or replace defective part

(Cont'd)

SILVERTONE 4550—(*Cont'd*)

Weak reception, Poor sensitivity	1) poor antenna system. Repair or replace 2) poor tube. Replace 3) receiver not aligned. Follow alignment procedure 4) low "A" battery. Recharge 5) faulty output tube. Replace
Poor tone	1) receiver not properly tuned. Explain proper tuning to customer 2) overloading of output. Reduce volume control setting 3) too high signal input. Shorten antenna or insert 0.00005-mfd. series condenser 4) faulty 1H4G, 1H6G or 1J6G tube. Replace
Hum	1) faulty electrolytic condenser. Replace
Audio howl	1) chassis not floating on rubber cushions. Wooden spacer strips not removed from under chassis. Remove the two chassis shipping bolts and remove wooden spacer strips. Be sure shaft or knobs do not touch cabinet
Improper wave switch action	1) defective contact in wave switch. Repair or replace 2) loose set-screw on gear sector. Re-set and tighten set-screw sector
Tuning eye not working	1) defective contact at volume control switch. Repair or replace 2) defective tube. Replace 3) "open" or "shorted" 1-megohm resistor, R-8, in tuning eye cable socket. Repair or replace
Dial off calibration	1) dial pointer shifted. Re-set pointer. See alignment procedure on mnfr's service sheet 2) defective padder or trimmer. Replace
Noisy variable tuning condenser	1) wiper fingers making poor contact. Clean and tighten fingers 2) "shorting" or "dirty" plates. Repair

SILVERTONE 4559

Same Case Histories as those listed for Silvertone 4419 receiver

SILVERTONE 4563, 4564

Same Case Histories as those listed for Silvertone 1986 receiver

SILVERTONE 4565

Same Case Histories as those listed for Silvertone 4465 receiver

SILVERTONE 4566

Inoperative	1) no power at outlet. Check outlet for power. Check contact of power cord plug in outlet 2) defective wave switch contacts. May be caused by stiff leads holding contacts open. Repair or replace 3) *C-21* not properly grounded. Tighten 4) "open" or "shorted" part or connection, particularly *C-9, C-17, C-19.* Repair 5) shield cap of 6F5G tube cutting through insulation of grid lead. Repair
Weak reception, Poor sensitivity	1) faulty antenna system. Repair or replace 2) receiver out of alignment. Follow alignment procedure 3) "open" or "shorted" padder or trimmer. Replace

(Cont'd over)

SILVERTONE 4566—*(Cont'd)*

Whistling or squealing	1)	poor alignment. Follow alignment procedure
	2)	speaker lead too near chassis. Move speaker lead away from chassis
	3)	faulty 6B5 tube. Replace
	4)	faulty 6A7 or 78 i-f tube. Replace
	5)	defective *C-21* condenser. Replace
	6)	tube shield clamps not making good contact. Clean and tighten
	7)	"open" condenser *C-14*. Replace
Audio oscillation as volume control is reduced	1)	faulty 6B5 tube. Move shielded grid lead of 6H6G tube between 6H6G and 6B5; or replace 6B5.
Whistling or squealing at high-frequency end of band "A"	1)	misplaced lead. Move lead running from band "A" oscillator trimmer to padder
Distortion	1)	caused by oscillation. See *"Whistling or squealing,"* above
	2)	faulty condenser *C-17, C-19*. Replace
Hum	1)	faulty 6H6G or 6F5G tube. Replace
	2)	faulty electrolytic condensers *C-12, C-21*. Replace
	3)	resistor *R-6* "shorting" to 6A6G heater. Remove "short"
Broad tuning, Double peak	1)	faulty 6H6G tube. Replace
Tone control in bass position greatly reduces volume	1)	faulty tone control. Try applying 4.5 volts from center terminal of tone control to outer terminals. If trouble persists, replace tone control
Improper tuning-eye operation	1)	faulty 6G5 tube. Replace
	2)	"open" or "shorted" 1-megohm resistor, *R-16*, in tuning eye cable socket

SILVERTONE 4567

Same Case Histories as those listed for Silvertone 4466 receiver

SILVERTONE 4569

Inoperative	1)	no power at outlet. Check outlet for power. Check contact of power cord plug in outlet
	2)	defective wave-switch contacts. May be caused by stiff leads holding contacts open. Repair or replace
	3)	*C-21* not properly grounded. Tighten
	4)	"open" or "shorted" part or connection, particularly *C-9, C-17, C-19*. Replace
	5)	clip at end of shielding on 6F5G tube grid lead cutting through insulation. Repair
Weak reception, Poor sensitivity	1)	faulty antenna system. Repair or replace
	2)	receiver out of alignment. Follow alignment procedure
	3)	"open" or "shorted" padder or trimmer. Replace
Whistling or squealing	1)	poor alignment. Follow alignment procedure
	2)	speaker lead too near chassis. Move speaker lead away from chassis
	3)	faulty 6B5 tube. Replace
	4)	faulty 6A7 or 78 i-f tube. Replace
	5)	defective condenser *C-21*. Replace
	6)	tube shield clamps not making good contact. Clean and tighten
	7)	condenser *C-14* "open." Replace

(Cont'd)

SILVERTONE 4569—*(Cont'd)*

Audio oscillation as volume control is reduced	1)	faulty 6B5 tube. Move shielded grid lead of 6H6G tube between 6H6G and 6B5; or replace 6B5
Whistling or squealing at high-frequency end of band "A"	1)	misplaced lead. Move lead running from band "A" oscillator trimmer to padder
Distortion	1)	oscillation. See *"Whistling or squealing,"* above
	2)	faulty *C-17, C-19* condensers. Replace
Hum	1)	faulty 6H6G, 6F5G tube. Replace
	2)	faulty electrolytic, *C-12, C-21* condensers. Replace
	3)	resistor *R-6* "shorting" to 6A6G heater. Remove "short"
Broad tuning, Double peak	1)	faulty 6H6G tube. Replace
Tone control in bass position greatly reduces volume	1)	faulty tone control. Try applying 4.5 volts from center terminal of tone control to outer terminals. If trouble persists, replace tone control
Improper tuning eye operation	1)	faulty 6G5 tube. Replace. Do not tighten clamp too tight
	2)	"open" or "shorted" one megohm resistor, *R-16*, in tuning eye cable socket. Repair or replace

SILVERTONE 4584

Same Case Histories as those listed for Silvertone 1986 receiver

SILVERTONE 4585

See also Case Histories listed for Silvertone 4465 receiver

Distortion	1)	"shorted" second det. plate by-pass condenser

SILVERTONE 4586, 4586A, 4586B

See also Case Histories listed for Silvertone 4486 receiver

Hum, Whistling or squealing	1)	check for "open" 0.012-mfd. condenser. Replace with 0.01-mfd. 600-volt unit. (Condenser is mounted on back of chassis and connects from A-C to ground)

SILVERTONE 4587

Inoperative	1)	no power. Check outlet for power. Check contact of power cord plug in receptacle
	2)	defective "on-off" switch. Repair or replace
	3)	"open" or "shorted" part or connection. Test by means of continuity or voltage tests. Repair or replace
	4)	"shorted" trimmer or padder. Replace
Weak reception, Poor sensitivity	1)	faulty antenna system. Repair or replace
	2)	receiver out of alignment. Follow alignment procedure
	3)	"open" or "shorted" part or connection. Test by means of continuity or voltage tests. Repair or replace
	4)	trimmer adjusting screw stripped. Replace
Hum	1)	defective electrolytic condensers *C-41 C-44, C-45*. Replace

(Cont'd

SILVERTONE 4587—*(Cont'd)*

Audio howl	1)	chassis not floating on rubber cushions. Wooden spacer strips not removed from under chassis. Loosen chassis mounting screws and remove wooden spacer strips. Be sure shafts or knobs do not touch cabinet
	2)	failure to cut the two pieces of tape, used for shipping, that are tied from the dial housing to the back of the cabinet. Remove tape
Improper wave switch action	1)	defective contact. Repair or replace
	2)	set-screw in gear sector loosened. Reset and tighten set-screw
Dial off calibration	1)	use shielded type 6C5G oscillator tube.
	2)	dial pointer slipped. Reset pointer
	3)	defective padder or trimmer. Replace
	4)	receiver out of alignment. Follow alignment procedure
Noisy variable tuning condenser	1)	wiper fingers making poor contact. Clean and tighten fingers
	2)	"shorting" or "dirty" plates. Repair or clean
"Flash tuning" light remains on	1)	faulty relay contacts. If the A.F.C. Flash Tuning mechanism does not operate properly, first check the toothed disc and spring arm. The spring arm should touch each of the teeth that have been bent up and should not touch any of the other teeth, as the Station Selector knob is turned. To adjust the spring arm, so that it does touch only the bent up teeth, proceed as follows: Loosen the "adjusting screw," which will permit the spring arm to be tipped so that it does make contact only with the bent up teeth. Then tighten the adjusting screw Another likely cause of improper A.F.C. Flash Tuning operation is the relay. A small amount of dust may interfere with proper closing of the contacts. Blow out the contacts or pass a strip of plain paper back and forth between them
	2)	"open" or "shorted" relay coil. Repair or replace
Set not silent between flash stations	1)	faulty relay. Repair or replace
Noisy	1)	solder flexible lead between fixed and movable parts of *No. 10154148950* Band Indicator Bracket

SILVERTONE 4588, 4588A

Same Case Histories as those listed for Silvertone 4488 receiver

SILVERTONE 4589

See also Case Histories listed for Silvertone 4569 receiver

Inoperative at high-frequency half of broadcast band	1)	check 0.0041-mfd. condenser which bypasses osc. coil to ground. Replace with 0.005-mfd. unit

SILVERTONE 4593

Inoperative	1)	no power at outlet. Check outlet for power. Check contact of power cord plug in outlet
	2)	defective wave switch contacts. May be caused by stiff leads holding contacts open. Repair or replace
	3)	"open" or "shorted" part or connection. Check by means of voltage or continuity tests. Repair or replace

(Cont'd)

SILVERTONE 4593—*(Cont'd)*

Weak reception, Poor sensitivity	1)	faulty antenna system. Repair or replace
	2)	receiver out of alignment. Follow alignment procedure
	3)	"open" or "shorted" padder or trimmer. Replace
Whistling or squealing	1)	poor alignment. Follow alignment procedure
	2)	speaker lead too near chassis. Move speaker lead away from chassis
	3)	tube shield clamps not making good contact. Clean and tighten
	4)	"open" condenser *C-13*. Replace
	5)	"shorted" resistor *R-9*. Repair or replace
Distortion	1)	caused by oscillation. See *"Whistling or squealing,"* above
	2)	faulty condensers *C-17, C-18, C-19*. Replace
Hum	1)	faulty electrolytic condensers *C-15, C-22*. Replace
Tuning eye not working	1)	faulty 6H5 tube. Replace
	2)	"shorted" *R-6* resistor. Repair or replace

SILVERTONE 4598

Same Case Histories as those listed for Silvertone 4472 receiver

SILVERTONE 4600 Auto Radio

Inoperative	1)	blown fuse. Replace
	2)	"dead" vibrator or tubes. Replace
	3)	faulty part or connection. Check by means of continuity or voltage tests. Repair or replace
Weak reception, Poor sensitivity	1)	"grounded" antenna. Disconnect from receiver and check with high-reading ohmmeter to car body
	2)	receiver out of alignment. Follow alignment procedure
	3)	antenna improperly matched. Make antenna-matching adjustments: Tune set to weak station at about 1500 kc. Turn adjusting screw to point affording maximum volume. (A weak station must be used to prevent the AVC action of the receiver from interfering with accurate peaking.) If a peak cannot be reached with the trimmer, the capacity of the car's antenna may be such that the other antenna-tap adjustment should be used
Dial off calibration	1)	set not properly aligned. Follow Alignment Procedure
"Hash"	1)	loose mounting nuts. Securely tighten all mounting nuts and screws of power supply and antenna coil. Be sure case grounding clips are in place to make tight fit of case covers
Noise (persists when engine is running and antenna is disconnected from receiver)	1)	due to chassis pickup. If receiver has identification *No. 101.458* on the label inside the case cover, connect a 0.1-mfd. 400-volt condenser between tube-heater end of choke *L-9* and ground

(Cont'd)

SILVERTONE 4600 Auto Radio—*(Cont'd)*

Volume drops to low value when volume control is decreased, but then increases again as the control is turned still lower

1) remove the chassis from the case and disconnect the leads to the two outside terminals of the volume control. Then connect a 22½-volt B battery between the center terminal and the case of the control. Rotate the control two or three times throughout its range. This should correct the trouble, after which the leads should be soldered to the outside terminals again.

Note: Do not connect the B battery between the center terminal and any of the other terminals of the control, as this will damage the unit

SILVERTONE 4601 Auto Radio

See also Case History listed for Silvertone 4600 Auto Radio receiver

Interference (chassis pick-up heard even when antenna plug is removed from its socket in the case)

1) connect a 0.1-mfd. 200-volt condenser across the 6-volt heater supply leads, i.e., connect one side of the condenser to the heater of the 6U7G i-f tube and the other side to a grounding terminal mounted under the i-f shield mounting nut. The condenser is located between the resistors *R-7* and *R-8*. Keep the leads to condenser as short as possible (This condenser has been added at the factory when the identification number reads *101,463 B* or a subsequent letter)

SILVERTONE 4602, 4603

Filament circuit (tubes burning out)

1) the 1G5G tube and the 1C7G tube are connected in series with each other. The 1D5GP and 1F7G also are connected in series with each other. Accordingly, if any one tube burns out, its companion tube also will not light. It is necessary, of course, to replace merely the burned out tube; the other then will light. The burned out tube can be identified through the fact that the full voltage of the "A" battery will appear across its filament prongs

Speaker adjustment, Rattling,

1) two types of speakers have been used. One has a single adjusting screw at the back; the other has two adjusting screws. Speaker rattle can be corrected by turning these screws. In the speaker having two adjusting screws, tighten one screw and loosen the other slightly until the rattle is eliminated

Bias cell (service note when working with receiver on test bench)

1) the bias cell is filled with thick liquid. When the receiver is in its normal position the liquid in the bias cell will come in contact with the carbon block and the inside of the metal container. However, the receiver may be stood on its end when working on it on the service bench. In this position the bias cell may be upright and the liquid may not touch the carbon block. If this happens, it will cause severe distortion. Accordingly, the necessary precaution should be observed when working on the receiver on the service bench

Whistle at 930 kc

1) a whistle, due to a beat between the second harmonic (930 kc) of the 465 kc i-f, and a 930-kc signal may be experienced. In localities where the 930 kc station is one that is freguently listened to, it will be desirable to shift the whistle to some other point where it will not be objectionable. This can be done by shifting the i-f frequency of the receiver

(Cont'd)

SILVERTONE 4602, 4603—*(Cont'd)*

Whistle at 930 kc —(*Cont'd*)

Determine at what point between 900 kc and 960 kc the whistle will be least objectionable. Dividing this frequency by two will give the new i-f frequency to which the receiver should be aligned. For example, if it is determined that a whistle at 915 kc would not be objectionable, the i-f should be realigned at 915/2 or 457.5 kc. Try to select the new frequency as near as possible to 465 kc

Align the i-f at the new frequency and then realign the rest of the receiver

Battery replacement

1) the dry "A" battery should be replaced when its voltage drops to 3.4 volts (with receiver turned "on" full). The "B" battery should be replaced when its total voltage has dropped to 51 volts (under load)

SILVERTONE 4604, 4605

Filament circuit (tubes burning out)

1) since the tubes have two-volt filaments and the "A" supply is four volts, a series parallel arrangement is used for the filament circuit. The 1C7G, the 1D5GP i-f and the 1H4G detector-AVC tubes are connected as one parallel group. This group is connected in series with the 1J6G tube across the "A" supply. The 1H4G second a-f and 1D5GP first a-f tubes are connected in series with each other across the "A" supply. If any one tube burns out, it will affect the filament voltage and current of its companion tube

Battery replacement

1) the dry "A" battery should be replaced when its voltage drops to 3.4 volts, under load. "B" batteries should be replaced when the voltage of each battery has dropped to 34 volts, under load. Because of the class "B" output circuit the "B" drain will vary with volume at which the set is played. Accordingly, the user should be told that for longest battery service the set should not be played louder than necessary

Whistle at 930 kc

1) a whistle, due to a beat between the second harmonic (930 kc) of the 465-kc i-f, and a 930-kc signal may be experienced. In localities where the 930-kc station is one that is frequently listened to, it will be desirable to shift the whistle to some other point where it will not be objectionable. This can be done by shifting the i-f frequency of the receiver

Determine at what point between 900 kc and 960 kc the whistle will be least objectionable. Dividing this frequency by two will give the new i-f frequency to which the receiver should be aligned. For example, if it is determined that a whistle at 915 kc would not be objectionable, the i-f should be realigned at 915/2 or 457.5 kc. Try to select the new i-f frequency as near to 465 kc as possible

Align the i-f at the new frequency and then realign the rest of the receiver

SILVERTONE 4608, 4609

Replacing two flash light batteries for Dial Flash-O-Light	1)	it is important that both flash light batteries face in the same direction when put in the holder. That is, the top center contact of one battery must touch the bottom of the shell of the other battery. Otherwise, the voltages of the batteries will buck each other and there will be no voltage for the dial light
Whistle at 930 kc	1)	see Case History for this same trouble symptom listed under Silvertone 4604-5
Code interference	1)	install wave trap Part *No. 1013114256* in aerial circuit

SILVERTONE 4610

Distortion at low volume	1)	add a 0.01-mfd. 200-volt condenser from cathode of 6B6G tube to ground. (Chassis marked with the letter "B," or a subsequent letter already have this condenser (*C-29*) installed)
Code interference	1)	install aerial-circuit wave trap Part *No. 1013117417* (operates at about 465 kc)
Whistles, Cross-modulation (when receiver is operated near powerful station)	1)	install wave trap Part *No. 1013117416*

SILVERTONE 4611

Tubes burned out	1)	all of the tubes (except the rectifier) are connected in series with each other. Therefore, if any one tube burns out, the others will not light. It is necessary to replace only the burned out tube of course; the others will then light. The full heater voltage of approximately 49 volts will appear across the filament prongs of the burned-out tube
Whistle at 930 kc	1)	see Case History for this same trouble symptom listed for Silvertone 4614 receiver
Hum	1)	try reversing the line cord
Increasing tuning eye sensitivity	1)	change the 1-megohm resistor in the cable socket to a 250,000-ohm unit

SILVERTONE 4612A, 4614

Whistle at 930 kc	1)	a whistle, due to a beat between the second harmonic (930 kc) of the 465-kc i-f, and a 930-kc signal may be experienced. In localities where the 930 kc station is one that is frequently listened to, it will be desirable to shift the whistle to some other point where it will not be objectionable. This can be done by shifting the i-f frequency of the receiver Determine at what point between 900 kc and 960 kc the whistle will be least objectionable. Dividing this frequency by two will give the new i-f frequency to which the receiver should be aligned. For example, if it is determined that a whistle at 915 would not be objectionable, the i-f should be realigned at 915/2 or 457.5 kc. Try to select the new i-f frequency as close to 465 kc as possible Align the i-f at the new frequency and then realign the rest of the receiver

SILVERTONE 4615

Fuses blow repeatedly	1)	insulate filament circuit chokes from Candohm resistor. Also insulate shield at bottom of vibrator section of chassis

SILVERTONE 4619

Whistle at 930 kc	1)	see Case History for this same trouble symptom listed for Silvertone 4614 receiver

SILVERTONE 4620, 4621

Same Case Histories as those listed for Silvertone 4602 receiver

SILVERTONE 4624, 4625

Same Case Histories as those listed for Silvertone 4604 receiver

SILVERTONE 4628, 4629

Same Case Histories as those listed for Silvertone 4608 receiver

SILVERTONE 4630, 4631

Same Case Histories as those listed for Silvertone 4602 receiver

SILVERTONE 4632A, 4633A

Whistle at 930 kc	1)	a whistle, due to a beat between the second harmonic (930 kc) of the 465-kc i-f, and a 930 kc signal may be experienced. In localities where the 930 kc station is one that is frequently listened to, it will be desirable to shift the whistle to some other point where it will not be objectionable. This can be done by shifting the i-f frequency of the receiver Determine at what point between 900 kc and 960 kc the whistle will be least objectionable. Dividing this frequency by two will give the new i-f frequency to which the receiver should be aligned. For example, if it is determined that a whistle at 915 kc would not be objectionable, the i-f should be realigned at 915/2 or 457.5 kc. Try to select the new i-f frequency as near to 465 kc as possible Align the i-f at the new frequency and and then realign the rest of the reciver
Bias cell service note (when chassis is on test bench)	1)	do not attempt to test the bias cells with a voltmeter. Ordinarily these cells have an indefinitely long life and should not be the cause of any trouble. The cells must be in their holders in the proper direction so that the polarity of the bias applied to the tubes will be correct. The zinc shell of the cells is the negative terminal and must connect to the tube grids. If the cells are removed from their holders, be sure that they are replaced so that the polarity will be correct

SILVERTONE 4634, 4635

Same Case Histories as those listed for Silvertone 4604 receiver

SILVERTONE 4638, 4639

Same Case Histories as those listed for Silvertone 4608 receivers

SILVERTONE 4644A, 4645A

Battery replacement	1)	the dry "A" should be replaced when its voltage drops to 3.4 volts, under load. "B" batteries should be replaced when the voltage of each battery has dropped to 34 volts under load
Whistle at 930 kc	1)	see Case History listed for this same trouble symptom under Silvertone 4632A receiver

SILVERTONE 4648, 4649

Same Case Histories as those listed for Silvertone 4608 receiver

SILVERTONE 4651

Same Case Histories as those listed for Silvertone 4614 receiver

SILVERTONE 4660

Same Case Histories as those listed for Silvertone 4611 receiver

SILVERTONE 4663

Code interference	1)	install aerial-circuit wave trap Part *No. 1013114256*. The trap is normally pretuned to the 465-kc i-f frequency so that normally, no further adjustment is necessary. However, should interference still be experienced, tune the receiver btween 550 and 600 kc. Then adjust the wave trap (by means of the trimmer screw at the bottom of the container) until the interference is eliminated

SILVERTONE 4664

Whistle at 930 kc	1)	see Case History for this same trouble symptom listed under Silvertone 4632A receiver

SILVERTONE 4665

Distortion at low volume	1)	add a 0.01-mfd., 200-volt condenser from 6B6G tube cathode to ground. (All chassis marked with letter "B" or a subsequent letter have already had this condenser *C-28* incorporated)
Code interference	1)	install 465-kc wave trap Part *No. 1013117417*
Whistle, Cross-modulation	1)	install wave trap Part No. *1014117416*

SILVERTONE 4666

Audio-frequency oscillation	1)	6Q7G second detector grid lead too close to the adjacent 6V7G output tube. Move the 6Q7G grid lead away
Improper operation of the "Lo-Noise" control circuit	1)	insufficient difference between the "break-in" and "drop out" points can be corrected by changing the 6Q7G Whisper Tuning tube. The 6A8G i-f tube also has an effect. Try interchanging the 6Q7G "Lo-Noise" control tube with the 6Q7G second detector tube
	2)	another change that will improve the action of the "Lo-Noise" control circuit is replacement of the 700-ohm resistor, *R-17*, with a 300-ohm one. This change has been incorporated in production in chassis stamped with the letter, "D," or a subsequent letter

(Cont'd)

SILVERTONE 4666—*(Cont'd)*

Improper operation of "Lo-Noise" control ck't. —*(Cont'd)*	3)	if further improvement is required, the 150-ohm resistor, *R-2*, may be "shorted" out. This change will also increase the sensitivity of the AMERICAN band and the minimum sensitivity of the Tuning Eye about ten times
Hum (when front control knob is in the "Lo-Noise" position)	1)	change 6Q7G "Lo-Noise" control tube. Sometimes, shifting the position of the heater leads to this tube will also minimize hum

SILVERTONE 4667

Whistling or squealing	1)	check all tube shields and see that they make good electrical contact to their base clips
Whistle at 930 kc	1)	see Case History listed for this same trouble symptom under Silvertone 4632A receiver
Whistles, Cross modulation	1)	install wave trap Part *No. 1013117416*

SILVERTONE 4669

Same Case Histories as those listed for Silvertone 4610 receiver

SILVERTONE 4677

Same Case Histories as those listed for Silvertone 4667 receiver

SILVERTONE 4680

Audio-frequency oscillation	1)	6Q7G second detector grid lead too close to the adjacent 6V7G output tube. Move the 6Q7G grid lead away
Improper operation of the "Lo-Noise" control circuit	1)	insufficient difference between the "break-in" and "drop out" points can be corrected by changing the 6Q7G Whisper Tuning tube. The 6A8G i-f tube also has an effect. Try interchanging the 6Q7G "Lo-Noise" control tube with the 6Q7G Second Detector tube
	2)	another change that will improve the action of the "Lo-Noise" control circuit is replacement of the 700-ohm resistor, *R-17*, with a 300-ohm one. This change has been incorporated in production in chassis stamped with the letter "F" or a subsequent letter
	3)	if further improvement is required, the 150-ohm resistor, *R-2*, may be "shorted" out. This change will also increase the sensitivity of the AMERICAN band and the minimum sensitivity of the Tuning Eye about ten times
Increasing sensitivity of the Tuning Eye	1)	the minimum sensitivity of the Tuning Eye can be increased about ten times by "shorting" out the 150-ohm resistor *R-2*, as mentioned in the preceding paragraphs. Another change that will increase the sensitivity of the Tuning Eye without changing the sensitivity of the set or the action of the "Lo-Noise" control is to replace the 1-megohm resistor *R-11*, with a 250,000-ohm resistor. This resistor is incorporated in the Tuning Eye cable socket. This change has been incorporated in production in chassis stamped with the letter "C", or a subsequent letter

(Cont'd

SILVERTONE 4680—*(Cont'd)*

Hum (occurring when front control knob is in "Lo-Noise" position)

1) change 6Q7G "Lo-Noise" control tube. Sometimes, shifting the position of the heater leads to this tube will also minimize hum

SILVERTONE 4681, 4684

Same Case Histories as those listed for Silvertone 4667 receiver

SILVERTONE 4685

Same Case Histories as those listed for Silvertone 4665 receiver

SILVERTONE 4686

Same Case Histories as those listed for Silvertone 4666 receiver

SILVERTONE 4687

Same Case Histories as those listed for Silvertone 4667 receiver

SILVERTONE 4688

Tuning motor hums but does not run

1) reversing contacts on back switch not closing. Make a thorough check of all switch adjustments and check carefully to see that the reversing contacts are set correctly when the mechanism is in the various positions

2) motor stalled due to mechanical overload, and clutch *not* slipping. Such an overload may be caused by any one or a combination of the following:
   - (*a*) binding of dial pointer against dials, dial frame, or cabinet. Also, rough, rusty, or bent pointer slide rail
   - (*b*) pointer drive cable too tight
   - (*c*) jammed or stuck guide pulleys
   - (*d*) crossed dial cord on dial drum
   - (*e*) drive drum gear out of mesh
   - (*f*) misalignment or tight cam shaft bearings
   - (*g*) cam shaft sprung or bent
   - (*h*) collar on left end of cam assembly binding against left end bracket
   - (*i*) excessive friction between pawl and station selector cam due to rough or burred surfaces
   - (*j*) set-up crown gear assembly binding
   - (*k*) gang condenser drive gears out of mesh and binding
   - (*l*) tight, jammed or sticking gang condenser

Trouble in A.F.C. system

1) first connect the antenna and tune in a powerful local station. See that the A.F.C. switch is in center position (A.F.C. off)

Next, detune the receiver dial until the music or speech becomes somewhat distorted. Throw the A.F.C. switch into the A.F.C.-on (clockwise) position. This should improve the quality of the program being received

Similarly detune the receiver in the opposite direction, with A.F.C. switch in center position. Place A.F.C. switch in clockwise position and again check for improved quality of reception

It will be noted that the correction for mis-tuning afforded by the A.F.C. system is not as marked at stations near

(Cont'd)

SILVERTONE 4688—*(Cont'd)*

Trouble in AFC system —(*Cont'd*)

the low-frequency end of the dial scale as it is at the higher broadcast frequencies. This is characteristic of A.F.C. systems. However, if throwing the A.F.C. switch into the extreme clockwise position has no effect on the signal, or is effective for mistuning in one direction only, check the receiver as follows:

- (*a*) Re-align i-f, broadcast band, and discriminator trimmers
- (*b*) check all tubes in the receiver. Defective 6H6 and 6J7 tubes, also the r-f, 1st-detector and i-f tubes may cause poor A.F.C. action
- (*c*) if the above procedure fails to remedy the defect in A.F.C. action, check the entire A.F.C. circuit itself for possible troubles

SILVERTONE 4700 Auto Radio

Whistle at 900 to 920 kc

1) in localities where a strong 910-kc station is in operation, a whistle may be experienced at 900 to 920 kc. This whistle is due to a beat between the second harmonic (910 kc) of the 456-kc i-f and the 910 kc station. Such a condition can be corrected by changing the i-f frequency to a higher or lower value until the whistle disappears. However, the i-f amplifier should not be shifted to a frequency higher than 465 kc nor lower than 445 kc but should be as close to 456 kc as possible

If the i-f frequency is changed, it will be necessary to realign the rest of the receiver in the usual manner

SILVERTONE 4701 Powr Shiftr

(for 4½-volt Battery Receivers)

Low "A" voltage output

1) when the "A" voltage is excessively low, the rectifier, condensers or transformer may be defective. Check the switch plug position carefully for correct location for load connected to "A," and also make sure one pilot lamp only is used when in the *CC, DD,* or *EE* position and two pilot lamps when in the *FF* position. These must be Type 43 pilot lamps.

To check the transformer, remove one transformer lead from the rectifier and measure for a-c voltage indicated on the wiring diagram. To check the rectifier remove wires from choke "*D*" and condenser "*G*,"—also disconnect one side of jumper wire and measure d-c voltage across each side of rectifier. This should be 1.9 to 2.1 volts, d-c with the switch plug in position *CC* and only one pilot lamp in the circuit.

IMPORTANT: The copper sulfide rectifier is designed to give the voltages indicated on the wiring diagram when the unit is warmed up to normal operating temperatures. This heating up period is usually about 20 minutes with the Powr Shiftr "A" circuit loaded. The rectifier's characteristics are peculiar and for an accurate check the unit must be tested when hot.

When the Powr Shiftr has been out of service for a long time (4 months or more) the "A" voltage may test low due to the inactive life of the rectifier. This is an inherent characteristic of the copper sulphide rectifier. The unit may be reactivated by placing a direct short for 3 to 4 minutes across the rectifier from the center lug to either outside lug of the rectifier. *WARNING! Two* pilot lamps must be in the circuit and the switch plug should be in position *CC*, otherwise the pilot lamps will be burned out. Low "A" voltage may also be caused by a dropping in capacity of the input condenser "*G*." To check this, another condenser of 500 to 1000-mfd. can be connected across this condenser, and if an appreciable rise is observed in the output voltage it is obvious that the input condenser is low in capacity.

(Cont'd over)

SILVERTONE 4701 Powr Shiftr—*(Cont'd)*

No "B" voltage output
1) check the 25Z6GT tube
2) the transformer should be tested by measuring the a-c voltage developed across each half of the plate winding with the *red* leads disconnected
3) check all carbon resistors for correct resistance values

Excessive hum in radio connected to Powr Shiftr
1) when excessive hum is noticed in the radio, it may be due to either the "A" supply or the "B" supply. The hum will be very loud when the input condenser "*G*" opens in service, and this open condenser will cause the output voltage to drop from 6.6 volts to 4.9 volts without load on the Powr Shiftr and the switch plug in position *CC* and only one pilot lamp in the circuit. The hum will be somewhat less in volume if the second section or output condenser has opened, and this will not change the output voltage.

When the hum is caused by the "B" supply, the condensers of this filter circuit have probably opened. If the input condenser has opened, the output voltage will drop from 104 to approximately 100 volts without load on the 90 volt tap. Less hum is caused when the output condenser opens and the output voltage is not changed.

To determine whether the hum is introduced by the "A" supply or the "B" supply, batteries may be substituted for each separate supply while one circuit is being tested.

SILVERTONE 4708 Powr Shiftr

(for 2 to 3-volt Battery Receivers)

Low "A" voltage output
1) when the "A" voltage is excessively low the transformer, condensers or rectifier may be defective.

To check the transformer, remove one *green* lead from the rectifier and measure for a-c voltage indicated on the wiring diagram. Low "A" voltage may be caused by a dropping in capacity of the input condenser "*G*." To test for this condition, another condenser of 500 to 1000-mfd. may be connected across this condenser, and if an appreciable rise in the output voltage is observed it is obvious that the input condenser is low in capacity. *IMPORTANT*: The copper sulfide rectifier is designed to give the voltages indicated on the wiring diagram when the unit is warmed up to normal operating temperatures. This heating up period is usually about 20 minutes with the Powr Shiftr "A" circuit loaded. The rectifier's characteristics are peculiar and for an accurate check the unit must be tested when hot.

When the Powr Shiftr has been out of service for some length of time (4 months or more) the "A" voltage may test low due to the inactive life of the rectifier. This is an inherent characteristic of the copper sulfide rectifier. To reactivate the rectifier it is only necessary to short the "A" plus and "A" minus terminals for a period of 4 to 5 minutes. The high temperature developed in the rectifier during this period has the tendency to restore the discs to their normal rectifying capacity. The unit will not be harmed by this process

No "B" voltage output
1) test 25Z6GT tube
2) check power transformer by measuring the a-c voltage developed across each half of the plate winding with the *red* leads disconnected
3) check carbon resistors for correct resistance values

Excessive hum in receiver connected to Powr Shiftr
1) when excessive hum is noticed from the radio it may be due to either the "A" supply or the "B" supply. The hum will be very loud when the input condenser "*G*" opens in service, and this open condenser will cause the output voltage to drop from 5.6 volts to 4.0 volts without load on the "A" supply. The hum will be somewhat less in volume if the second section or output condenser has opened, and this will not change the output voltage.

When the hum is caused by the "B" supply, the condensers of this filter circuit have probably opened. If the output condenser has opened, the output voltage will drop from 148 (on 135V tap) to 104 volts without

(Cont'd)

SILVERTONE 4708 Powr Shiftr—*(Cont'd)*

Excessive hum in receiver connected to Powr Shiftr —(*Cont'd*)
load on the "B" supply. Less hum is caused when the output condenser opens and the output voltage is not changed.

To determine whether the hum is introduced by the "A" supply or the "B" supply, batteries may be substituted for each separate supply while one circuit is being tested.

SILVERTONE 4709 Powr Shiftr

(for 6-volt Battery Receivers)

Excessive hum in receiver connected to Powr Shiftr
1) some radios are not equipped with three or four-wire cables which bring the vibrator and filament circuits out of the chassis to the power source. Excessive hum will probably be a problem in this type receiver until the vibrator is disconnected at its lugs or terminals inside the chassis and brought out with separate wires and connected to the Power Shiftr direct. For obtaining minimum hum it is important that the filament load is connected to the "*F*" terminals, which supply power with minimum voltage ripple. An open input condenser on the "*F*" supply will introduce excessive hum also and the output voltage will drop to 6.4 volts without load.

The filter condenser open on the "*V*" supply will also introduce hum and cause the voltage to drop to 4.53 volts without load.

SILVERTONE 4714 Powr Shiftr

(for 1½-volt Battery Receivers of 4, 5, or 6 Tubes)

Failure of "A" supply (low "A" voltage)
1) check storage battery for a terminal voltage of 6 volts
2) the pin plug position of the tap changer on top the chassis must be in *Position 4* for a 4 tube radio, and likewise for *Position 5* and *6*. The auto lamp acting as a voltage regulator ballast will burn dimly without a load on the Powr-Shiftr, and the greater the load the brighter this lamp will be. Inside the chassis are three 5-ohm rheostats for factory adjusting the voltage with the correct load at each tap. Rheostat *Q* is set at 3.5 ohms, *R* at 4.0 ohms, and *S* at 4.67 ohms. A small screwdriver may be used for changing this calibration when desired

Failure of "B" supply (low, or no "B" voltage)
1) substitute new vibrator
2) check 6X5GT tube
3) check transformer by measuring a.c. voltage developed across each side of the secondary (after removing the tube)
4) check both 0.5-mfd. 100-volt by-pass condensers for breakdown

Excessive hum or hash
1) faulty vibrator. Substitute new one
2) make sure that good solid ground is provided to the ground pin of vibrator as well as for the ground connection of the two 50-ohm resistors from the vibrator contacts to ground (for leaking off all r-f)
3) check these resistors for open circuit
4) test all by-pass condensers for "open"
5) keep all connecting leads to radio as short as possible. If long leads are necessary, use shielded wire for the extension

SILVERTONE 4720

See also Case Histories listed for Silvertone 4602 receiver

Inoperative
1) check for "short" between primary and secondary circuits of antenna coil (either within the coil itself or in external circuits)

SILVERTONE 4724

Same Case Histories as those listed for Silvertone 4604 receiver

SILVERTONE 4728

Same Case Histories as those listed for Silvertone 4608 receiver

SILVERTONE 4730

Same Case Histories as those listed for Silvertone 4602 receiver

SILVERTONE 4748

Same Case Histories as those listed for Silvertone 4608 receiver

SILVERTONE 4760, 4761

Tubes burn out (filament circuit note)	1)	all of the tubes except the rectifier tube are connected in series. Therefore, if any one tube burns out, the others will not light. It is necessary to replace only the burned out tube; the others then will light. The full heater voltage, approximately 43 volts, will appear across the filament prongs of the burned out tube
Whistle at 930 kc	1)	see the Case History listed for this same trouble symptom under Silvertone 4632A receiver

SILVERTONE 4762

Hum (when operated on A-C line)	1)	reverse line-cord plug
Hum (only when station is tuned in — particularly at high-frequency end of dial)	1)	connect a 0.01-mfd. 200-volt condenser across the 4-mfd. condenser C-7
Whistle at 930 kc	1)	see the Case History listed for the same trouble symptom under Silvertone 4632A receiver

SILVERTONE 4763

Same Case Histories as those listed for Silvertone 4663 receiver

SILVERTONE 4764

Same Case Histories as those listed for Silvertone 4664 receiver

SILVERTONE 4765

Same Case Histories as those listed for Silvertone 4665 receiver

SILVERTONE 4766

Same Case Histories as those listed for Silvertone 4666 receiver

SILVERTONE 4767

Same Case Histories as those listed for Silvertone 4667 receiver

SILVERTONE 4769

Same Case Histories as those listed for Silvertone 4610 receiver

SILVERTONE 4770

Same Case Histories as those listed for Silvertone 4760 receiver

SILVERTONE 4771

Same Case Histories as those listed for Silvertone 4761 receiver

SILVERTONE 4772

Same Case Histories as those listed for Silvertone 4762 receiver

SILVERTONE 4776

Whistle at 920 kc	1)	a whistle due to a beat between the second harmonic (920 kc) of the 460 kc i-f, and a 920-kc signal may be experienced. In localities where the 920-kc station is one that is frequently listened to, it will be desirable to shift the whistle to some other point where it will not be objectionable. This can be done by shifting the i-f frequency of the receiver Determine at what point between 890 kc and 950 kc the whistle will be least objectionable. Dividing this frequency by two will give the new i-f frequency to which the receiver should be aligned. For example, if it is determined that a whistle at 905 kc would not be objectionable, the i-f should be re-aligned at 905/2 or 452.5 kc. Try to select new i-f frequency as close as possible to 460 kc
Interfering whistle appearing when receiver is tuned to either of certain pairs of stations	1)	caused by two stations having a frequency difference equal to the i-f frequency (460 kc) of the receiver and will be evidenced by a whistle appearing when the receiver is tuned to either of the stations. It may be further localized by tuning the receiver to each of these stations and then stopping the oscillator in each case, by grounding the oscillator stator section of the variable tuning condenser *C-8* to chassis. If the whistle, in each case, still persists, it is being caused by the beat between these two stations and may be corrected by shifting the i-f frequency of the receiver, to a frequency other than the difference frequency of the two local or strong signals (stations) The i-f amplifier should not be shifted to a frequency higher than 475 kc, nor lower than 445 kc, but should be as close to 460 kc as possible Align the i-f at the new frequency and then re-align the rest of the receiver
Phono motor servicing and adjustments	1)	speed adjuster screw is on top of motor frame. Turn speed adjuster so the felt will protrude 1/16 inch when all the way in. Adjust governor so as to leave 1/16 inch between felt and disc, then secure by means of governor screw
	2)	adjust end bearing set screw so shaft is free to turn without play
	3)	apply oil to felt pad which rubs against the governor disc to insure smooth operation

SILVERTONE 4777

Same Case Histories as those listed for Silvertone 4667 receiver

SILVERTONE 4781

Same Case Histories as those listed for Silvertone 4681 receiver

SILVERTONE 4784

Same Case Histories as those listed for Silvertone 4664 receiver

SILVERTONE 4785

Same Case Histories as those listed for Silvertone 4665 receiver

SILVERTONE 4786

See also Case Histories listed for Silvertone 4666 receiver

Inoperative, Weak reception — 1) "leaky" or "shorted" 0.003-mfd. condensers connected from plate to cathode circuits of 6V7G tubes. Also check large 140-ohm flexible resistor (located at 6V6G socket) for overheating due to this trouble

SILVERTONE 4787

Same Case Histories as those listed for Silvertone 4687 receiver

SILVERTONE 4788

Same Case Histories as those listed for Silvertone 4688 receiver

SILVERTONE 4789

Same Case Histories as those listed for Silvertone 4610 receiver

SILVERTONE 4790

See also Case Histories listed for Silvertone 4680 receiver

Inoperative, Weak reception — 1) if osc. padder has no effect, check for "shorted" or "leaky" 0.00005-mfd. mica condenser in oscillator circuit

SILVERTONE 4791, 4792

Same Case Histories as those listed for Silvertone 4666 receiver

SILVERTONE 4796

Same Case Histories as those listed for Silvertone 4776 receiver

SILVERTONE 4798

Same Case Histories as listed for Silvertone 4667 receiver

SILVERTONE 4799

Same Case Histories as listed for Silvertone 4799 receiver

SILVERTONE 4887

"Stuttering" — 1) change 6J5G phase inverter tube

SILVERTONE 5276 Record Player

Re-centering armature of phono pickup unit — 1) if the centering adjustment of the armature has been disturbed it will be necessary to remove the pickup mechanism from the tone arm by removing the needle-holding screw and the two mounting screws from the front of the tone arm, holding the pickup assembly to keep it from dropping.

Unsolder the two leads from the lugs on the terminal board at the rear of the pickup. Insert a small rod or nail into the armature needle hole and replace the needle holding screw, tightening it

(Cont'd)

SILVERTONE 5276 Record Player—*(Cont'd)*

Re-centering armature of phono pickup unit —(*Cont'd*) — to hold the rod securely. If the armature clamping screws have not been disturbed, they should be loosened. This will permit the armature to be moved from side to side, the rod acting as a lever to perform this operation.

The proper adjustment is obtained when the armature is moved to the extreme position on each side (the movement being limited by the armature striking the pole pieces) and then brought to the mid position between these two extremes. Screws should then be tightened

The armature position should be central between the pole pieces and at right angles to them. With a little practice, the correct adjustment of the armature will be obtained. The air gap between the pole pieces and the armature should be kept free from dust, filings, and other foreign material which would obstruct the movement of the pickup armature

Replacing viscoloid damping block in phono pickup — 1) the viscoloid damping block which is attached to the front end of the armature shank serves as a mechanical filter to eliminate undesirable reasonances and to cause the frequency response to be uniform. Should it be necessary to replace this damping block, the pickup mechanism should be removed from the tone arm as explained above. Remove screw and the damping block from the pickup assembly. Make sure that the shaft of the armature which contacts the viscoloid is clean. Then insert the new damping block so that it occupies the same position as that of the original block, and is in correct vertical alignment with the armature. The hole in the block is somewhat smaller than the diameter of the armature in order to permit a snug fit. With the damping block properly aligned on the armature, screw with its washer should then be replaced. Heat should be applied to the armature (viscoloid side) so that the damping block will fuse at the point of contact and become rigidly attached to the armature. The iron should be applied only long enough to slightly melt the block, causing a small bulge on both sides

Replacing phono pickup coil — 1) whenever there is defective operation due to an "open" or "shorted" pickup coil, this coil should be replaced. Remove the pickup mechanism and terminal board as described above. Remove screws and the magnet assembly. Remove the bakelite coil support (with coil attached) and insert the new coil support assembly in its place, after which replace the magnet assembly and center the armature as described above, then re-assemble the remainder of the unit. Only rosin core solder should be used for soldering the coil leads and pickup leads to the pickup terminal board, and the centering spring to the armature

Replacing main spring — 1) in case of main spring failure, the entire spring barrel and gear should be replaced. Remove spring barrel spindle screw by unscrewing to *right*. Remove the "C" washer and two pillar screws holding bottom plate. Remove plate and intermediate spindle shaft. Replace main spring barrel intermediate spindle shaft, and bottom plates

(Cont'd)

SILVERTONE 5276 Record Player—*(Cont'd)*

Winding shaft spring 1) this spring functions as a friction rachet. It may be removed by first removing pin holding winding gear on shaft, removing shaft, and then the screw holding the spring

Adjusting the governor 1) the mesh of the worm and fibre gears is adjusted by rotation of the eccentric spindle bearings. The adjustments should be made so that the worm meshes properly with the fibre gear and rotates freely without binding. The bearings should be accurately aligned with each other. The minimum of spindle endplay which permits smooth operation should be used

Regulating speed 1) after assembly, adjust the speed regulator until the turntable rotates at 78 r.p.m.; then loosen the speed regulator screw and set pointer to center of speed indicator scale; tighten screw and recheck turntable speed

Lubrication 1) all moving parts of the motor should be thoroughly cleaned and lubricated every six months to prevent excess wear and improper operation. A small amount of grease should be applied to the worm gear of the governor, the gear of the winding shaft, and on the small pinion gear. All other points should be lubricated with a drop of light oil (S.A.E. 10). Avoid oils of the 3-in-1 type. All motor parts should be covered with a light film of oil to prevent rusting

SILVERTONE 5502

Pushbutton tuning out of adjustment 1) loosen slotted screwhead made accessible when the pushbutton knob is pulled off of its plunger. Set up station by unlocking the mechanism, tuning in the station, pushing in the plunger (being careful not to detune the station), and securely locking the adjustment by tightening the slotted screwhead

SILVERTONE 5620, 5623 Record Players

Bass reproduction too pronounced (on Model 5620 only) 1) connect a 200,000 or 150,000-ohm resistor across the pickup terminals

Lubrication 1) use good grade light motor oil (S.A.E. 10). Avoid oils of the 3-in-1 type

2) remove turntable to reach three oil cups thru turntable shaft hole in motorboard. Oil main bearings at the three oil cups provided. Fill level and repeat; three or four fillings may be required to saturate felt retainers

SILVERTONE 5695 Record Player

See also Case Histories listed for Silvertone 5620 Record Player

End play 1) loosen lock-nut on "thrust" set-screw at armature shaft bearing, and turn the "thrust" set-screw in or out so that armature shaft has a clearance of 0.005 inches (use paper gauge made from two or three thicknesses of stiff paper of proper thickness). Tighten lock nut and apply one drop of oil at end of armature shaft

SILVERTONE 5701

Circuit change to make Early run receivers comply with requirements of Underwriters Laboratories 1) insulate variable condenser from cabinet, and connect a 0.2-mfd. 400-volt condenser (*C-12*) between variable condenser frame and floating ground instead of between chassis base and floating ground. Also connect a 0.05-mfd. 400-volt condenser (*C-4*) between ground end of antenna coil primary and variable condenser frame to reduce the impedance between the antenna and floating ground to an acceptable point

SILVERTONE 5731 "MOTO-MATIC" Tuner for Auto Radios

(Used with Silvertone 6000, 6001, 6100 and 6101 Auto Radios)

Tuner fails to operate 1) failure of tuner to operate may lie in the selector switch. Remove back plate and place jumper wire from the first terminal on the end where lead enters switch case to the *red* wire terminal. This should cause tuner to operate on No. 1 button. Now repeat, going to the *red* and *blue*, *blue* to *brown*, etc., wire terminals. Each one of these should operate an armature arm. Doing this will give a check as to whether the contact finger from the preceding button is making contact when button is out. See schematic wiring diagram. If tuner operates in this manner, the individual contact fingers are not making contact when button is depressed. Remedies for the above are as follows:

First:—it may be necessary to bend contact fingers so that good connection is made. *Second*:—The selector switch case may be bulged in the center. This can be corrected by placing a strap across both sides

The selector switch plunger back-up plate may become loosened, in which case it will be necessary to push back in place and put a wood wedge between this plate and switch case

Chattering or skipping of tuner clutch when under full load 1) this is caused by the engaging pins not being engaged deep enough into the main driving gear. Press the clutch down by hand over the top of the coil and note if the clearance of 1/64" exists from clutch flange to clutch face proper. If gap is greater, remove clutch arm and bend angle closer to clutch outside face. This arm is made of soft annealed steel and bends easily. Replace and check; several trials may be necessary

After making magnetic clutch adjustments it may be necessary to readjust the stop located above clutch so that motion from the engaged position to the disengaged position can be held at a minimum. *Note*: when clutch is disengaged, it is important that the clutch pins do not drag when tuning manually

Clutch sticks open when button is depressed 1) may be caused by many misadjustments. *First*:—the clutch arm may be warped during the process of bending so that the embossed bumps do not ride on the outside edge of the clutch face. Correct this by rebending clutch arm. *Second*:—it is imperative that both embossed bumps on the underside of the clutch arm apply an equal pressure to the clutch face while engaging clutch. Check this by depressing clutch arm and

(Cont'd over)

SILVERTONE 5731 "MOTO-MATIC" Tuner—*(Cont'd)*

Clutch sticks open when button is depressed —*(Cont'd)*		measuring a predetermined clearance with the 0.004" shim supplied with kit. In other words, compare the spacing of the embossed bumps from the clutch face. Correct any differences by bending slightly the forked section of the clutch arm
End play in condenser drive shaft	1)	the condenser drive shaft should not have any lateral or axial play. If some does exist, it can be taken out by bending back the end play adjusting nut lockwasher tabs and taking up on the nut until no play is felt and no additional torque is required to turn shaft

SILVERTONE 6000, 6001 Auto Radios

See Case Histories listed for Silvertone 5731 "Moto-Matic" Tuner used with Auto Radio

SILVERTONE 6003, 6004

Dial light replacement	1)	to replace dial lights, remove the push-button escutcheon
Whistle at 930 kc	1)	shift whistle to some other point where it will not be objectionable, by shifting i-f frequency of receiver. Determine at what point between 900 kc and 960 kc the whistle will be least objectionable. Dividing this frequency by two will give the new i-f frequency to which the receiver should be aligned. For example, if it is determined that a whistle at 915 kc would not be objectionable, the i-f should be realigned at 915/2 or 457.5 kc. Try to select the new frequency as close as possible to 465 kc Align the i-f at the new frequency and then realign the rest of the receiver

SILVERTONE 6014, 6015

Same Case Histories as those listed for Silvertone 4632A receiver

SILVERTONE 6016, 6017

Whistle at 930 kc	1)	a whistle, due to a beat between the second harmonic (930 kc) of the 465-kc i-f, and a 930-kc signal may be experienced. In localities where a 930-kc station is one that is tuned frequently, it will be desirable to shift the whistle to some other point where it will not be objectionable. This can be done by shifting the i-f of the receiver Determine at what point between 900 kc and 960 kc the whistle will be least objectionable. Dividing this frequency by two will give the new i-f to which the receiver should be aligned. For example, if it is determined that a whistle at 915 kc would not be objectionable, the i-f should be realigned at 915/2 or 457.5 kc. Try to select the new i-f as near to 465 kc as possible Align the i-f at the new frequency, and then realign the rest of the receiver in the usual manner

SILVERTONE 6024

Same Case Histories as those listed for Silvertone 6003 receiver

SILVERTONE 6028

Hum, Vibration (in phono motor)	1)	a small amount of hum when starting, decreasing to a negligible amount when running, is normal. If excessive vibration occurs it may be due to: (*a*) insufficient lubrication, or any failure that will cause binding (*b*) leather washer not oiled. (Check to make certain that the leather washer is above the steel washer) (*c*) motor not properly supported from motor board (*d*) burrs on poles of rotor or stator. Remove with fine emery cloth
Removing rotor	1)	the rotor and turntable assembly supply rests on the ball bearing at bottom of vertical bearing. Remove by lifting up carefully
Adjusting rotor	1)	loosen the three screws that hold the rotor to the turntable, insert three 16-mil shims at equal distances around the gap between the rotor and stator, and then carefully tighten the three screws. The top of the rotor must be flush with the top of the stator; add additional steel washers beneath the stator if necessary
Lubrication	1) 2) 3)	leather washer should be oil soaked light oil should be used on ball bearing under main shaft light oil should be used on outer and inner shaft and stator bearing surfaces
Whistle at 910 kc	1)	a whistle, due to a beat between the second harmonic (910 kc) of the 455 kc i-f and a 910 kc signal may be experienced. In localities where the 910 kc station is one that is frequently listened to, it will be desirable to shift the whistle to some other point where it will not be objectionable. This can be done by shifting the i-f frequency of the receiver Determine at what point between 880 kc and 940 kc the whistle will be least objectionable. Dividing this frequency by two will give the new i-f frequency to which the receiver should be aligned. For example, if it is determined that a whistle at 915 kc would not be objectionable, the i-f should be realigned at 915/2 or 457.5 kc. Try to select the new i-f frequency as near to 455 kc as possible Align the i-f at the new frequency and then realign the rest of the receiver in the usual manner

SILVERTONE 6029 Record Player

Same Case Histories as those listed for Silvertone 6028 (except note concerning Whistle at 910 kc)

SILVERTONE 6034

Same Case Histories as those listed for Silvertone 6003 receiver

SILVERTONE 6036

Whistle at 930 kc	1)	a whistle, due to a beat between the second harmonic (930 kc) of the 465 kc i-f and a 930 kc signal may be experienced. In localities where the 930 kc

(Cont'd)

SILVERTONE 6036—*(Cont'd)*

Whistle at 930 kc —(*Cont'd*) station is one that is frequently listened to, it will be desirable to shift the whistle to some other point where it will not be objectionable. This can be done by shifting the i-f frequency of the receiver

Determine at what point between 900 kc and 960 kc the whistle will be least objectionable. Dividing this frequency by two will give the new i-f frequency to which the receiver should be aligned. For example, if it is determined that a whistle at 915 kc would not be objectionable, the i-f should be realigned at 915/2 or 457.5 kc. Try to select the new i-f frequency as near as possible to 465 kc.

Align the i-f at the new frequency and then realign the rest of the receiver in the usual manner

SILVERTONE 6038

See also Case Histories listed for Silvertone 6036 receiver

Circuit changes in Late-run receivers 1) chassis identified as *No. 101.517-1* have incorporated changes intended to stabilize the spread bands. Also, the model No. 6193 has been added to the two model numbers in which the original chassis, *No. 101.517*, were used. The intermediate frequency has been changed from 465 kc that was used in the original chassis to 455 in the later chassis

Silver mica condensers, *C-57*, *C-58*, and *C-59* have been added, and a triple trimmer condenser has replaced the trimmers *C-26*, *C-27*, and *C-28*. The later chassis use different knobs, escutcheons and push-buttons

SILVERTONE 6044, 6045

Same Case Histories as those listed for Silvertone 4632A receiver

SILVERTONE 6046, 6047

Same Case Histories as those listed for Silvertone 6036 receiver

SILVERTONE 6052, 6053

Weak reception (batteries low) 1) the 4½-volt dry "A" battery should be replaced when its voltage drops to 3.4 volts, under load. The "B" batteries should be replaced when the voltage of each battery has dropped to 34 volts, under load

Whistle at 930 kc 1) see Case History for this same trouble symptom listed under Silvertone 6036 receiver

SILVERTONE 6054, 6055

See also Case Histories listed for Silvertone 6052 receiver

Rattling, Distortion 1) two types of speakers have been used in these receivers. One has a single adjusting screw at the back; the other has two adjusting screws. Speaker rattle can be corrected by turning these screws. In the speaker having two adjusting screws, tighten one screw and loosen the other screw slightly until the rattle is eliminated

(Cont'd)

SILVERTONE 6054, 6055—*(Cont'd)*

Distortion (incorrect C-bias voltage on 1G5G output tube) 1) the two bias cells cannot be tested with an ordinary voltmeter. If they have been accidentally "shorted," or if a voltage should be put across them with a continuity meter or ohm meter, their operation will be temporarily impaired. However, they will return to normal operating conditions after a few moments. The outer shell is the *negative* terminal and the carbon block the *positive* terminal of the cells. If they are removed from their holders, be sure to replace them correctly. The *negative* terminal (the shell) should face the grid of the tube

SILVERTONE 6064

Same Case Histories as those listed for Silvertone 4632A receiver

SILVERTONE 6072, 6073

Whistle at 930 kc 1) see Case History listed for this same trouble symptom under Silvertone 6036 receiver

SILVERTONE 6074

Whistle at 930 kc 1) see Case History for this same trouble symptom listed under Silvertone 6036 receiver

Changes to stabilize band-spread 1) in chassis *No. 101.505*, the band spread can be stabilized by connecting a 0.0001355-mfd. silver mica condenser *C-34* in shunt with the trimmer condenser *C-7*. Chassis in which this change has already been made are now numbered *101.515-1* and *101.515-2*

SILVERTONE 6077

Same Case Histories as those listed for Silvertone 6072 receiver

SILVERTONE 6079

Same Case Histories as those listed for Silvertone 6074 receiver

SILVERTONE 6100, 6101 Auto Radios

Ignition noise 1) any ignition noise that may remain will always seem worse when no station is tuned in. This is so because under this condition the Automatic Volume Control feature increases the receiver sensitivity to maximum. It may be found that as soon as any station strong enough to be worth listening to is tuned in, the noise will disappear. It is advisable to check ignition noise in a location that is free from electrical disturbances such as are caused by power lines, street car lines, and electrical equipment. This is necessary to prevent mistaking electrical noises from outside sources for noises caused by the car's electrical system. *Always be sure the hood is tightened down when checking for ignition noise.* If objectionable ignition noise still persists, proceed as follows:

(Cont'd over)

SILVERTONE 6100, 6101 Auto Radios—*(Cont'd)*

Ignition noise —*(Cont'd)*		(*a*) disconnect the aerial plug from the receiver. If any ignition interference is still present, check for defect in ignition system of car, loose high-tension leads, ungrounded metal tubes or rods, ungrounded muffler, tire static, etc. (*b*) if no ignition interference is heard with the aerial plug disconnected as described in Paragraph (a), re-insert the aerial plugs and disconnect the lead-in at the point where it comes out of the shielded aerial cable. If interference is now noticed, make sure that the shielded aerial cable is thoroughly grounded to the car frame (*c*) if no interference is noticed when the aerial lead-in is disconnected as described in Paragraph (*b*), it indicates that the interference is being picked up by the aerial. In this case, check the car ignition system, wiring, ungrounded rods or pipes, etc., in the usual manner
Trouble in "Moto-matic" tuner (when used with the receiver)	1)	see Case Histories listed for Silvertone 5731 "Moto-matic" tuner

SILVERTONE 6104 Auto Radio

Rattling	1)	recenter voice coil in usual manner with 3 narrow paper "feelers." First remove dust cover by softening its cement with a light application of acetone, taking care not to let it flow into the air gap. Cement the dust cover back in place with Ambroid cement after the adjustment has been completed
Whistle at 900 to 920 kc	1)	in localities where a strong 910 kc station is in operation, a whistle may be experienced at 900 to 920 kc. This whistle is due to a beat between the second harmonic (910 kc) of the 455 kc i-f and the 910 kc station. Such a condition can be corrected by changing the i-f frequency to a higher or lower value until the whistle disappears. However, the i-f amplifier should not be shifted to a frequency higher than 465 kc nor lower than 445 kc but should be as close to 455 kc as possible If the i-f frequency is changed, it will be necessary to realign the rest of the receiver in the usual manner

SILVERTONE 6109

Hum (in chassis *No. 101.508*)	1)	connect a 10-mfd. electrolytic condenser (Part *No. 101209144*) across the 0.025-mfd. condenser (*C-9*) now connected in detector cathode circuit. *Positive* lead of new condenser should be connected to 6J7 detector tube cathode, and *negative* lead to chassis

SILVERTONE 6110, 6111

See also Case History listed for Silvertone 6109 receiver

Inoperative (no tubes light up)	1)	all of the tube heaters, except the rectifier tube, are connected in series. Accordingly, if any one tube burns out, the others will not light. The full transformer heater voltage will appear across the heater terminals of the burnt out tube *(Cont'd)*

SILVERTONE 6110, 6111—*(Cont'd)*

Replacing tubes	1)	the chassis must be removed from the cabinet to replace tubes: Unscrew and remove the push button locking nut in the center of the tuning knob, and pull off the knob. (Do not lose the small steel key that fits in the slot of the knob and shaft.) Pull off the volume control knob. Unscrew the three felt-headed screw-feet at the bottom of the cabinet. Pry out the left side of the cabinet at the top. Unhook the spring that holds this side cover. Pull the chassis out of the cabinet, pushing down two push buttons at a time so that they slip under the cabinet top Before replacing the chassis, push down all six buttons and insert a rod, screw driver or other suitable implement in either of the two large round holes at the knob end of the mechanism, so that all of the push-button levers remain depressed. Then put the chassis back into the cabinet and remove the implement used, through the knob opening in the cabinet end, allowing the buttons to come up into place in the opening in the cabinet top. Replace the cabinet feet, knobs, push-button locking nut, and cabinet end. It will be necessary to reset the push-buttons to the stations as explained below under "Adjusting the push-buttons"
Adjusting the push-buttons	1)	unlock the mechanism by loosening the screw at the center of the tuning knob, for a few turns. Push the button all the way in and tune in the desired station while the button is held in firmly. Then release the button before tuning in the next station. Proceed in the same manner for the remaining buttons. Lock the mechanism by tightening the screw in the tuning knob

SILVERTONE 6120

Weak reception, Distortion	1)	insulation on *blue* lead between first i-f coil and mixer tube plate jammed or cut, permitting wire to "ground"

SILVERTONE 6124

Same Case Histories as those listed for Silvertone 6003 receiver

SILVERTONE 6125

Whistle at 930 kc	1)	see Case History for the same trouble symptom listed under Silvertone 6036 receiver

SILVERTONE 6134

Same Case Histories as those listed for Silvertone 6003 and Silvertone 6155 receivers

SILVERTONE 6136, 6138

Same Case Histories as those listed for Silvertone 6038 receiver

SILVERTONE 6140

Same Case Histories as those listed for Silvertone 6003 receiver

SILVERTONE 6144

Same Case Histories as those listed for Silvertone 4632A receiver

SILVERTONE 6146

Same Case Histories as those listed for Silvertone 6016 receiver

SILVERTONE 6152, 6153

See also Case History listed for Silvertone 6155 receiver

Changes to stabilize bandspread in chassis identified as *No. 101.537*	1)	shunt a 0.00015-mfd. silver mica condenser across the trimmer *C-7*. (The i-f peak in Chassis *No. 101.537* is 465 kc. That in Chassis *No. 101.537-1* is 455 kc)
Whistle at 930 kc	1)	see Case History for this same trouble symptom listed under Silvertone 6036 receiver

SILVERTONE 6155, 6156, 6159

Inoperative	1)	check for "short" between oscillator coil primary and secondary windings due to close spacing between them. To clear "short," remove one turn from end of primary which is nearest secondary winding. Check 150-ohm resistor connected to injector grid of 6A8G tube, and also the tube, for damage due to this "short"

SILVERTONE 6162

Whistle at 930 kc	1)	see remedy for this same Trouble Symptom listed under Silvertone 6036 receiver

SILVERTONE 6164

Same Case Histories as those listed for Silvertone 4632A receiver

SILVERTONE 6172

Same Case Histories as those listed for Silvertone 6072 receiver

SILVERTONE 6173

Same Case Histories as those listed for Silvertone 6073 receiver

SILVERTONE 6193

Same Case Histories as those listed for Silvertone 6038 receiver

SILVERTONE 6226 Wireless Record Player

Turntable speed too low	1)	check rubber rim on idler wheel. If oil-soaked, replace

SILVERTONE 6230

Noisy reception	1)	replace 1-watt resistor mounted on back of volume control

SILVERTONE 6301

Intermittent reception, Noisy	1)	resolder all coil ends of antenna and oscillator coils, being careful to clean away enamel from wire first
	2)	check for "snapped" leads on 0.25-mfd. coupling condenser *C-29* in speaker compartment

SILVERTONE 6306

To extend frequency range of Chassis *No. 101.593* to cover 1600 kc	1)	peak the oscillator trimmer *C-11* with the signal generator set to 1605 kc (and the receiver variable tuning condenser fully *open*) instead of to 1520 kc as given in the original service sheet for this receiver. This changes the range of push-button *No. 5* from 920-1570 kc to 950-1600 kc

SILVERTONE 6325

Inoperative, Weak reception (plate voltages low)	1)	check for faulty 50-ohm 25Z6G plate circuit resistor

SILVERTONE 6326

Hum	1)	check 12J5GT and 12F5GT tubes carefully for heater to cathode leakage. Replace if leakage is indicated
	2)	if these tubes are O.K., inspect to see if 12F5GT tube is provided with a shield. If not, install one
	3)	disconnect 1-meg. plate resistor *R-6* of the 12J5GT tube, and also 500,000-ohm plate resistor *R-11* of the 12F5GT tube (disconnect each resistor at the B+ end only). Now connect these loose ends of resistors *R-6* and *R-11* together and also to one end of a 100,000-ohm ¼-watt resistor and one terminal of a 0.1-mfd. 400-volt paper condenser. Connect other end of the 100,000-ohm resistor to the B+ line to which *R-6* and *R-11* were formerly connected. Connect the other terminal of the 0.1-mfd. condenser to the B— line
Microphonics	1)	insulate base of 12J5GT tube from socket with soft felt washer cut out to pass key and pins. Install a tight-fitting shield over tube in such a way that it does not touch chassis

SILVERTONE 6336

Increasing bass response for improved tone when receiver is used with a record player	1)	remove 100,000-ohm resistor now connected across phone jack terminals. Break lead going to "high" side of phono jack and connect a 200,000-ohm resistor (shunted by a 0.0005-mfd. mica condenser) in series with it. Now shunt a 1-meg. resistor with a combination of a 100,000-ohm resistor connected in series with a 0.01-mfd. 200-volt paper condenser. Connect the outside terminals of this combination between the B— lead from the phono jack and the side of the 200,000-ohm resistor and 0.0005-mfd. shunt condenser combination which is *away* from the phono jack

(Cont'd over)

SILVERTONE 6336—*(Cont'd)*

Microphonics

1) because of the increased bass response, there may now be a greater tendency toward microphonics. For this reason, the record player should not be put directly on top of the receiver cabinet.

In case of complaint due to microphonism, the following things to be checked, are listed in the order of their importance:

(a) Be sure that the two shipping bolts and the wood spacer strips have been removed.

(b) See that knobs, control shafts, and dial lights or dial mechanism do not touch the cabinet.

(c) See that the rubber bumpers at the rear of the chassis do not press on it more than enough to prevent shifting.

Although the foregoing three points are simple, and commonly known, very often insufficient attention is paid to them. *It is very important* that the points mentioned be *very thoroughly checked.*

(d) Any means of reducing the signal input will help, such as using a shorter antenna or connecting a small mica condenser (0.0001 to 0.0002-mfd.) in series with the antenna lead.

(e) All but initial production cabinets have two bracing strips added under the chassis mounting shelf at its end as follows:

Turn the cabinet upside down. (Be careful to protect the cabinet finish.)

Clamp one of the cleats along the under side-edge of the chassis itself. The end of the cleat should be against the cabinet back rail.

Using the cleat as a template, drill three 9/32" holes in the chassis mounting shelf. Be careful that none of the dirt from drilling gets into the speaker or chassis.

In the same manner, drill three holes at the other end of the chassis mounting shelf.

Clean off any splinters and bolt the cleats *tightly* to the underside of the chassis mounting shelf, with the bolt heads on the top side of the shelf. The flat washers go under the nuts.

(f) If the predominant microphonic tone is of low-frequency, improvement can be had by reducing the capacity of the coupling condensers in the audio amplifier. These are *C27* and *C29*, which should be reduced from 0.01-mfd. to 0.006-mfd., 600 volt. Both condensers must be changed to avoid unbalancing the push-pull circuit. This change will reduce the low frequency response and is not recommended except for extreme cases

SILVERTONE 6346, 6346A

Pickup arm of record changer keeps moving back and forth continuously and record does not change (in chassis identified by suffix numbers -4 or -5)

1) original servicing instructions for this receiver called for pickup arm to be adjusted to clear stack of records by only ⅛". This dimension should be made ¼". If pickup rises too close to bottom record, the stud may never clear the groove in the cam gear and arm will keep moving back and forth continuously

SILVERTONE 6400A, 6401A, 6402A

Reducing 25-cycle dial light flicker

1) change connection of 25-ohm resistor *R-4* to other side of dial light socket lead; i.e., change *R-4* connection from prong *No. 3* of 35Z5GT tube to prong *No. 2*

To improve operation of Chassis *No. 101.565-A-B* on 25 cycle a-c

1) replace speaker with new type having a field of higher inductance. Field coil resistance of new speaker is 550 ohms —same as that of present speaker

SILVERTONE 6403, 6404, 6405, 6406, 6407, 6408, 6409

Weak reception, Hum, Intermittent howl

1) check loop antenna for "opens" at corners

To broaden selectivity in chassis having no "suffix" number

1) replace first and second i-f transformers with new type which give decrease in selectivity. Also, change 47,000-ohm resistor *R-2* to 22,000 ohms

SILVERTONE 6425

Inoperative, Weak reception (plate voltages low)

1) check for faulty 50-ohm 25Z6G plate circuit resistor

SILVERTONE 6436

Same Case Histories as those listed for Silvertone 6336 receiver

SILVERTONE 6446, 6446A, 6447

Same Case Histories as those listed for Silvertone 6346 receiver

SILVERTONE 6490-B

Improving performance of receiver, (in Early-Production *No. 101.613* Chassis)

1) replace 4700-ohm resistor *R-7* with choke coil (Part *No. 1013040-442*)

SILVERTONE 6492, 6496

Same Case Histories as those listed for Silvertone 6403 receiver

SILVERTONE 6551

Hum

1) check filter condenser nearest rectifier in circuit

2) "ground" filter condenser can securely to chassis

To improve oscillator performance in receivers bearing Chassis *No. 101.620*

1) change 0.00005-mfd. condenser *C-6* to a 0.0001-mfd. mica condenser

To extend frequency coverage through 540 kc on receivers bearing Chassis *No. 101.620* or *No. 101.620-1*

1) change oscillator coil to new Part *No. 1012844769*. Change padder condenser to new Part *No. 1011744810*. Change dial to new Part *No. 1014044766*. Change loop antenna to new Part *No. 1012844788*

SILVERTONE 7000, 7001, 7002, 7003 (Chassis 132.811)

To improve performance of receiver	1)	increase 1-meg. avc isolating resistor *R-11* to 3-meg.
	2)	change electrolytic condenser from a 20-10 mfd. 150 v., 20-mfd. 25 v., to a 40-20 mfd. 150 v., 20-mfd. 25 v. unit in models 7000, (3211), and 7002

SILVERTONE 7049, 7051

Same Case History as listed for Silvertone 5502 receiver

SILVERTONE 7062

Weak reception, Insufficient sensitivity	1)	add a length of wire to the antenna cord supplied with the receiver—or, connect an outside antenna to it
25Z5 rectifier tube short-lived	1)	overloading the 25Z5 rectifier tube will very rapidly destroy it. An output "short" of only a few seconds duration will often destroy the tube. To insure sufficient bias on the power tubes for minimum current drain and load on the power supply and rectifier tube, adjust the section of the voltage divider at the *negative* end so it is 200 ohms
Speaker rattle	1)	cone off-center. Loosen center adjusting screw and re-center in usual manner with narrow paper or fibre "feelers"
Chassis "grounding" note	1)	do not attempt to attach a ground to the chassis, because it is not intended to be at ground potential. Do not touch the chassis while the cord is plugged in, as it may be at a high enough potential to give a nasty shock

SILVERTONE 7068

Same Case History as listed for Silvertone 5502 receiver

SILVERTONE 7069

Improving phono operation	1)	in chassis *No. 101.658*, remove short *green* wire connected between two terminals on phono-radio switch

SILVERTONE 7070

Same Case History as listed for Silvertone 5502 receiver

SILVERTONE 7071

Improving phonograph reproduction	1)	in chassis marked *100.384*, change 0.002-mfd. condenser *C27* in phono input network to a 0.001-mfd. 600-volt unit. Shunt a 330,000-ohm, ¼-watt resistor across this condenser

SILVERTONE 7099

Only very strong stations heard on FM	1)	remove 6J5GT tube from its socket. If the normal number of stations can now be heard, replace it with a new tube that does not have excessive cathode-to-heater leakage

SILVERTONE 7117 Auto Radio

6A7 tubes short-lived	1)	reduce oscillator plate voltage by connecting a 20,000-ohm ½-watt resistor in series with the B+ lead of the oscillator coil. By-pass this resistor to ground with a 0.1-mfd. 400-volt condenser

SILVERTONE 7167, 7168

Same Case History as listed for Silvertone 5502 receiver

SILVERTONE 7211, 7212, 7212A, 7213

Inoperative	1)	no current at outlet. Check outlet for current and be sure power cord plug is making good contact
	2)	defective "on-off" switch. Replace
	3)	"open" or "short" in set. Repair or replace faulty part
	3)	reversed polarity if operated on D-C. Turn plug half way around and re-insert it in its receptacle
	4)	"open" line cord. Replace
Weak reception, Poor sensitivity	1)	insufficient antenna pickup. Connect to outdoor antenna
	2)	defective tube. Replace
	3)	receiver out of alignment. Follow alignment procedure
Station interference	1)	receiver located near powerful stations. Do not uncoil all of the antenna supplied with receiver
Poor tone	1)	overloading. Reduce volume control setting
	2)	speaker out of adjustment. Repair or replace
Hum	1)	defective electrolytic condenser. Replace electrolytic condenser
	2)	reverse power plug if operated on A-C
Whistling or squealing	1)	antenna lead coiled around or near set. Run antenna wire away from the set

SILVERTONE 7225

Whistling or squealing	1)	check for "open" by-pass condensers
Distortion	1)	change in value of 150-ohm wire-wound flexible resistor in 25L6G cathode circuit. Replace with a 2-watt resistor

SILVERTONE 7226

Inoperative (none of tubes light up)	1)	all of the tubes are connected in series. Accordingly, if any one tube burns out, the others will not light. It is necessary of course, to replace only the burned-out tube; the others will then light
	2)	the M22HG resistor tube reduces the line voltage to the value required by the tube filaments. This tube is not replaceable by any other type. To replace it with a tube of different internal resistance would impair the operation of the receiver
Noisy reception, Interference	1)	in noisy locations try connecting the *black* lead in rear of chassis to a good water pipe or radiator ground. *Do not connect the ground wire directly to the chassis for harm will result!*

SILVERTONE Identification No. 100.301 Automatic Record Changer

Noise while cycling	1)	follower arm bent out of position. Straighten
Turntable rubs	1)	loosen set-screw on worm with an Allen wrench, and raise spindle about 1/32". Tighten set-screw
Does not cycle with "Reject" button	1)	check to see if trip link is releasing follower. If trip link releases follower but will not center on threads of worm, bend the follower arm
Motor slows down during cycling	1)	bend paddle end of follower arm down slightly, or loosen ejector screw slightly
Records do not drop	1)	tighten ejector screw slightly. Always check with full stack of 10-12" records in place. Set the screw so that bottom record just falls
Record drops on tone arm	1)	bend back end of follower arm up slightly. Make sure ejector screw is adjusted properly
Mechanism keeps repeating on top of worm	1)	bend trip link back slightly so as to loosen the trip spring tension on follower. It may be necessary to first loosen the set screw on the trip. If this does not correct the trouble, check the follower arm to make sure it is straight, and bend slightly if necessary
Mechanism keeps repeating on bottom of worm	1)	this indicates a bent follower arm. Straighten arm
Follower flutters while playing	1)	check to see if follower arm is all the way up to top of worm, if not, bend arm slightly in toward worm to stop binding
Follower arm binds	1)	bend follower arm away from fulcrum at both sides of rivet
Follower jams	1)	bend follower arm to straighten
Tone arm does not land at beginning of record, or misses record entirely	1)	check ejector to see if it is set for correct size of record. If ejector is set for correct record size, the "set down" position adjustment should be loosened and the position of the tone arm adjusted as described under *"Tone arm set-down position adjustment"*
Tone arm does not go into cycle at end of record	1)	check to see if record has spiral finishing groove. If it has not, reject record by means of reject button. If trouble lies with mechanism, adjust screw as described under *"Tone arm trip position adjustment"*
Records wear excessively	1)	check needle to see if worn out or defective. If needle is not cause of wear, lift the tone arm and increase the tension of the spring at the base as described under "needle pressure adjustment"
Tone arm slips out of record grooves, or slides across record	1)	This is usually due to insufficient needle pressure. The needle pressure may be increased by loosening the spring tension at the base of the tone arm as described under *"Needle pressure adjustment"*

(Cont'd)

SILVERTONE Identification No. 100.301 Automatic Record Changer—*(Cont'd)*

Tone arm slides across top record of stack	1)	this is due to the tone arm having insufficient height to clear the top record on the turntable. This can be remedied by raising the tone arm height by means of the "tone arm height adjustment"
"Wow" in record reproduction	1)	this is usually due to worn rubber rim on the idler wheel. If this is the case, replace the idler wheel

SILVERTONE Identification Nos. 101.205, 101.207, 101.208, 101.210 Automatic Record Changers

Tone arm does not set down in proper position on record	1)	turn off machine during the cycle just before the pickup arm descends to a record. Loosen set-screw in pickup crank (under motorboard), and while holding the crank in place, turn tone arm until needle is straight above the outside groove of record. Then retighten set-screw

---

SIMPLEX

SIMPLEX AC-DC Models

Tunable hum	1)	reconnect condenser now between B minus and one side of the power line, so that it is directly across the line

SIMPLEX Midget Receiver

Whistling or squealing (immediately upon connecting antenna to receiver)	1)	remove the 350-ohm resistor in series with the B supply return and ground. Ground the B minus. Insert this 350-ohm resistor in series with cathode of 2A5 tube instead

SIMPLEX DA

Inoperative, Intermittent reception, Weak reception	1)	i-f coils "open" or intermittently "open" due to moisture and corrosion. To repair, carefully remove coil, unwind about two layers of the inside winding. Pull the wire gently and the insulation will part at the break. Repair form with cement, replace coil and realign set
	2)	"open" driver transformer

SIMPLEX J

Inoperative at low-frequencies	1)	try a 400 or 500-ohm bias resistor in place of the 700-ohm resistor now used for the '24 detector-oscillator tube

SIMPLEX P

Inoperative	1)	check for "short" between stationary and movable plates of tuning condenser sections
	2)	check 0.00008-mfd. condenser connected from first det. negative filament to chassis

SIMPLEX PA (Dual-Band Battery Receiver)

Dial slips	1)	slip a 7/16 by 3/16 rubber grommet over the shaft and wind cord around this grommet instead of the bare shaft, as originally equipped

SIMPLEX R

Set smokes	1)	short-circuited 4-mfd. condenser in the power supply system

SIMPLEX V

Inoperative (voltages check O.K.)	1)	resolder all connections to insulated posts supporting common wiring junctions

SIMPLEX 4

Inoperative, Weak reception	1)	check 0.05-mfd. 400-volt micamold condenser W23615 for "short". If it is "shorted," check tone control, which often burns out simultaneously

SIMPLEX 5DA

Noisy	1)	check oscillator coil. Replace it to eliminate this trouble

SIMPLEX 6

Inoperative, Inoperative or weak on low-frequencies	1)	use a 400-ohm resistor in place of the 700 ohm resistor employed as the oscillator cathode bias resistor

---

SKYRAIDER

SKY RAIDER 178

Inoperative	1)	plate condenser (0.01-mfd.) connected from 42 output tube plate to ground "shorted." Due to its position in the circuit, this condenser is subjected to high voltage stress occasionally. Connect it across the output transformer primary (from plate to screen of the 42 tube) instead. This results in the same tone quality, but the condenser is subjected to less overload

---

SKYROVER

SKYROVER 224

Inoperative	1)	"open" filter condenser
	2)	"shorted" by-pass condenser
Whistling or squealing	1)	"open" by-pass condenser
	2)	increase value of 0.25--mfd. plate by-pass condenser on third r-f tube to 0.5-mfd.

SONORA

SONORA Receivers—General Servicing Notes

Replacing special tubes with less expensive easily obtainable standard types	1)	rewire for '27 tubes in the r-f, detector and first a-f, and a '45 in the output. Bolt five-prong sockets over the four prong ones in the r-f section. Bring up connections, carrying cathode connections through holes in rivets holding the coils in place. Return cathode to

(Cont'd)

SONORA Receivers—General Servicing Notes—*(Cont'd)*

Replacing special tubes with less expensive easily obtainable standard types —*(Cont'd)*		power pack through one side of unused filament wiring. Install a new power transformer with the following specifications: 700-volt center-tapped secondary, 2.5-volt center-tapped filament secondary, and a 5-volt secondary. Change the bias for the 27's to 500 ohms and connect the grid return to the '45 to the filament centertap. Discard the ballast tube Making these changes in the receiver costs less than half the price of new special type tubes
Mushy tone, Poor audio quality (in sets using Peerless dynamic speakers)	1)	burnish the contacts of the voice coil bands to the heavy copper strip (secondary) of output transformer. Reassemble and tighten securely
Whistling or squealing	1)	for oscillation in the r-f amplifier, connect a 1-mfd. condenser from the r-f "B" plus terminal to chassis or ground
Weak output from record player	1)	leakage between shield and wire comprising leads from pickup—especially during damp weather. Replace wires and pigtail ends of shields for effective grounding

SONORA A

Inoperative at the low-frequency setting of the tuning dial, Noisy reception at the high-frequency setting	1)	short-circuiting tuning condenser plates

SONORA A-11

Inoperative	1)	check for faulty filter condenser. Replace. Provide better ventilation for line ballast near filter condenser by leaving off back cover of receiver and also enlarging ventilation holes in bottom of cabinet
Intermittent reception	1)	volume control lugs "short" to chassis. Insert thin pieces of insulating material between them
Noise, and signal cut-off (between 90 and 125 on dial)	1)	rotor plates of tuning condenser touch metal shield of 6D6 tube. Slip small piece of mica or cardboard under tube base on side next to condenser so tube will be tilted just enough to clear the condenser rotor plates
Hum, Distortion	1)	inspect socket and prongs of plug-in tubular filter condenser for poor contact. Solder leads directly to pins on condenser for permanent good contact
Rattling	1)	check for loose celluloid dial cover. Tighten rivets that secure it in place

SONORA 28

Whistling or squealing	1)	due to inductive coupling between some of the r-f coils. Examine plate coil in first r-f transformer, and try turning it slightly so that oscillation does not occur when the volume control is advanced to maximum

SONORA 30

Weak reception	1)	"open" 100,000-ohm detector screen resistor (located below the resistor strip)

SONORA A30, A32, A36

Fading, Weak reception, Intermittent reception	1)	leaky 0.1-mfd. r-f coupling condensers
	2)	open-circuiting or open-circuited 0.1-mfd. r-f coupling condensers
Whistling or squealing	1)	add 2-mfd. by-pass condenser across terminals *7* and *8* to audio unit terminal strip
	2)	open-circuited 135-volt bleeder resistor
	3)	bleeder resistor changed to higher value
Hum, Distortion	1)	unmatched power output tubes
Weak, Distorted reproduction	1)	high-resistance coupling between voice coil and output transformer secondary. Clean and solder connections

SONORA A40, A44, A46

See also Case Histories listed for Sonora A30, A32, A36

Weak, Distorted phono reproduction	1)	high-resistance coupling between voice coil and output transformer secondary. Clean and solder connections
	2)	contacts of phono-radio transfer switch corroded
	3)	movable arm of phono volume-control corroded
Automatic stop inoperative, Motor stops before record is completed	1)	loosen motor mounting bolts. Shift motor so that distance between center of turntable spindle and center of pickup mounting screw is 9"

SONORA D-70

Fading, Distortion about 15 minutes after set is switched on	1)	leaky 0.05-mfd. audio coupling condenser. Becomes defective only when heated. Replace with new 200-volt unit

SONORA 70S

Hum Volume control does not reduce the volume properly	1)	"open" 8-mfd. electrolytic condenser (located under the resistor-condenser bank) Replace with a 300-volt unit

SONORA 74

Whistling or squealing (excessive screen voltage)	1)	check the 250,000 ohm resistor in screen grid circuit for partial or complete short." Replace

SPARTON

SPARTON Receivers—*(General Servicing Notes)*

Inoperative, Weak reception, Fading (in models using 484's and 183's as output tubes)	1)	"inoperative" condition caused by 183 tubes burning out due to decrease in value of 1250-ohm bias resistor. Replace with 10-watt unit
	2)	"weak reception" caused by "open" 0.000024-mfd. condenser in first r-f circuit—or to changed value of 2,500-ohm resistor shunting it
	3)	"fading" caused by "open" 0.6-ohm variable resistor in series with 183 tubes
Fading	1)	tuning condenser rotor plates loose from rotor shaft. Center-punch pot metal close to rotor shaft at several places to pinch the plates in tight
Fading in band-pass models	1)	poor contact where pin from tuner connects to the amplifier or to the bolts holding the various units to the mounting board
Dial does not track	1)	remove chassis from cabinet. Set dial pointer to correct setting. (Pointer is simply pressed on to shaft and often works loose due to vibration)
Microphonics (in models using Airplane Dials)	1)	make sure there is sufficient clearance between dial and cabinet as insufficient spacing here will cause trouble. It is also well to coat the wires passing through the oscillator coil with clear, heavy lacquer to damp out any possible vibration in them
Whistling or squealing, Howling, Motorboating sound (when set is started up—in models using 485 tubes)	1)	remove chassis, and with power on, tap the r-f and detector tubes one at a time to reveal the noisy tube. Replace it Thoroughly clean all wiper contacts on condenser gang rotor with *Carbona*. Realign r-f stages at 1200 kc
Improving performance by replacing tubes in old models using 484 and 182B or 183 type tubes	1)	replace 484 tubes with 56's. Replace 182B or 183 tubes with 45's and install new suitable power transformer. Take out last r-f stage and replace with 1st audio resistance-coupled out of detector stage. Change bias on 45 tubes

SPARTON EQUASONNE A.C. MODELS

Inoperative (set operates only when antenna is touched to coupling pin (under the back of the drum dial) between selector and r-f amplifier can, with volume control at "max" setting)	1)	defective component in the r-f selector can
	2)	r-f circuits out of alignment
	3)	with volume control full on, pull extra 485 tube used on selector can as amplifier almost out of socket and work it up and down so it makes and breaks contact with the socket terminals. If no loud "clicks" are heard, check for "open" plate choke or condenser beneath this socket

(Cont'd)

SPARTON EQUASONNE A. C. MODELS—*(Cont'd)*

Weak reception	1)	in models that have detector tube mounted on top of gang condensers, check the detector grid leak (located underneath the socket of the 485 tube)
	2)	coupling pin-jack between the tube box and gang condenser worn from vibration. Replace it
	3)	"open" 110-ohm wire-wound resistor connected between terminals *5* and *7* on terminal strip. Replace
Hum, Distortion	1)	check carefully to make sure that the r-f amplifier, pre-tuner, power pack, and condenser units are all well grounded. Ground any suspicious units with bonding braid
Noise	1)	check the ground connection to the panel, as a poor connection at this point will cause considerable noise
	2)	turn volume control completely off. If noise similar to static results, check detector plate choke. If new choke is difficult to obtain, remove all wire from old choke form and scramble-wind the form full of No. 36 enameled wire. Solder ends to terminals

SPARTON JR. D.C. RECEIVERS

Weak reception, Distortion	1)	replace 22½-volt "C" battery
	2)	defective type '224 tubes

SPARTON AC-7

Sudden changes in volume	1)	leaky cathode by-pass condenser

SPARTON 9

Weak reception	1)	increase value of voltage divider to 100,000 ohms (composed of two 50,000-ohm 1-watt resistors in series)

SPARTON 9A

Insufficient sensitivity	1)	replace the .0.006-mfd. condenser (connected from the power transformer primary to ground) with a 0.002-mfd. unit
Whistling or squealing over the entire dial	1)	dirty or corroded condenser-gang contacts Clean contacts carefully or solder flexible pigtails between the rotor and the condenser frame

SPARTON 9-30

No reception	1)	shorted plate by-pass condenser
	2)	loose bolts holding r-f unit to common connector plate
Intermittent reception	1)	broken wire on one of the band-pass coils in r-f unit
	2)	broken wire in detector plate circuit choke in r-f unit
	3)	loose prongs on r-f tube sockets
Weak reception on lower end of dial	1)	readjust compensators
	2)	readjust antenna series condenser
Noisy reception	1)	defective volume control
Hum	1)	dial-light socket shorting to chassis

SPARTON 12

Intermittent reception, Inoperative at low-frequency setting of tuning dial, (set resumes normal operation when chassis is jarred)	1)	high-resistance connection between the tuning condenser rotor plates and the shaft. Replace with a new tuning condenser gang, or repair by drilling each rotor section through the shaft and inserting a copper dowel pin into each hole drilled

SPARTON 14

Intermittent reception (shaking cabinet restores normal operation)	1)	wire from i-f transformer to type '58 tube short-circuiting to shield can of tube due to loss of insulation at this point. Put a short piece of spaghetti tubing on the lead
Weak reception at high-frequencies	1)	open-circuited 3,000-ohm resistor in first detector-oscillator cathode circuit
	2)	open-circuited 0.002-mfd. first detector-oscillator cathode by-pass condenser
Whistling or squealing	1)	electrolytic condensers lost capacity
Fading, Intermittent reception	1)	components mounted on terminal strip shorting to one another
Hum, Distorted reproduction	1)	electrolytic filter condensers have lost capacity. Replace
Hum, Distorted reproduction, (pentode output tube grids red hot)	1)	partially "shorted" dynamic speaker field coil. It should test 2,500-ohms from end to end and 400 ohms from bias tap to chassis
Hum	1)	electrolytic condensers dried up

SPARTON 16

Frequency drift, Fading, Whistling	1)	loose connections on oscillator coil, check and resolder these connections
	2)	do not fail to solder the oscillator coil connection that is made to a small bolt, as this bolt often works loose
Motorboating sound	1)	r-f signal from oscillator being impressed on second detector, causing periodic blocking of set through AVC action and periodic releases. Insert a static shield between the oscillator condenser stator and the adjacent r-f stator on the tuning condenser gang
Crackling when set is jarred	1)	install a pigtail between front end of rotor and the tuning condenser frame
Intermittent noise, Erratic operation	1)	if this increases when any part of chassis or tubes is tapped, check for looseness of rotor shaft in its bearings due to ordinary mechanical wear. This may be corrected by drilling and tapping the bearings for two short 6/32 setscrews, or by soldering the rotor plate hub to the shaft. Ground center of shaft with a pigtail in place of the original brush

SPARTON 18

Intermittent reception, Fading	1)	look for "shorted" or "opening" condensers or resistors on the terminal strip beneath the tube socket. A gentle pull on each unit will often show up the faulty one
	2)	unsoldered connections to wire-wound resistors
Weak reception, Unstable	1)	"open" 3,000-ohm resistor in cathode circuit of first detector-oscillator tube
	2)	bridge the 0.002-mfd. condenser connected from the oscillator coil in the cathode circuit to chassis with a new one to find out if the present unit is "open"
	3)	check 0.01-mfd. condenser connected between the AVC tube plate and its cathode
	4)	check the 100,000-ohm resistor connected to the AVC plate
No AVC control	1)	check 0.01-mfd. condenser between plate and cathode of the AVC tube
	2)	check the filter condensers
	3)	check for "open" grid returns
No control of volume	1)	cathode-heater leakage in '58 AVC tube
	2)	grounded noise-suppressor control lugs
Distortion, Hum, Poor control of volume	1)	defective electrolytic filter condensers (high leakage)
Whistling or squealing	1)	capacity of electrolytic condensers abnormally low

SPARTON 25

Inoperative	1)	check for "open" windings in i-f transformers due to coil leads snapping at lugs (inside of impregnating wax)
Inoperative (no plate voltage at i-f and oscill. stages, and low plate voltage at the other stages)	1)	"shorted" 1-mfd. cartridge type condenser located behind the push-pull input transformer. Check also its center terminal, as it may have shifted and be "shorting" to the chassis
Inoperative (plate and screen voltages check O.K.), High voltage between control-grid of first detector and ground. Receiver operates when the secondary coil is grounded, AVC inoperative	1)	replace secondary coil in control-grid circuit of first-detector tube
Weak reception (accompanied by little or no manual control of volume)	1)	"gassy" AVC tube. Replace
Intermittent reception	1)	check for "opening" windings in i-f transformers due to coil leads snapping at lugs (inside of impregnating wax)

SPARTON 25—*(Cont'd)*

Fading, Poor control of volume	1)	"leaky" 0.2-mfd. r-f, first detector, AVC and i-f secondary-return by-pass condensers
Fading	1)	high-resistance contact between the die-cast rotor plates on the condenser gang and the condenser shaft. Drill and tap holes in each rotor through to the shaft and insert set-screws
Whistling or squealing, Motorboating sound, Weak reception	1)	"open" 1-mfd. cartridge type condenser located behind the push-pull input transformer
	2)	if tubes, by-pass condensers etc. check O.K. connect an r-f choke into the first i-f cathode circuit, with a 0.5-mfd. condenser from cathode to ground
	3)	employ separate bias resistor (with its by-pass condenser) for first i-f stage. (Since one 250-ohm resistor is used for two tubes, it must be replaced by two 500-ohm resistors—one for each tube)
Hum	1)	loose power transformer laminations

SPARTON 26

See also Case Histories listed for Sparton 25 receiver

Intermittent reception	1)	replace the round metal-clad 1-mfd. condenser
	2)	leaky 0.2-mfd., 200-volt condenser. Replace with new unit
	3)	leaky 0.05-mfd., 400-volt condenser. Replace with new unit
	4)	leaky 0.006-mfd., 600-volt condenser. Replace with new unit

SPARTON 26AW

See also Case Histories listed for Sparton 25 receiver

Intermittent reception, Inoperative	1)	open-circuiting i-f transformer windings. Coil leads snap at terminal lugs

SPARTON 27A

Low volume, Distortion	1)	due to improper speaker phasing. Reverse coil connections on one of the speakers
No AVC action	1)	change in value of AVC resistor. Replace with new unit of proper value
Noisy reception	1)	defective inter-station noise-suppressor resistor. Replace with new unit

SPARTON 28

See also the Case Histories listed for Sparton 25 and 26AW receivers

Noisy reception, Intermittent reception at around 600 kc	1)	loose variable condenser plates. Secure plates to shaft with brass pins

SPARTON 30

See also Case Histories listed for Sparton 25, 26AW receivers

Does not play 10" or 12" records	1)	open contacts of indicating switch within kick-off arm compartment
	2)	plunger arm of solenoid "binding"
	3)	insufficient tension of plunger arm spring
	4)	open-circuited solenoid
Fuse blows when record is rejected	1)	indicating switch contacts shorting to kick-off arm compartment

SPARTON 36

Vibrator short-lived	1)	connect a 0.01-mfd. 1600-volt oil condenser across secondary winding of power transformer in the eliminator unit. Insulate condenser can with tape. Install this condenser in all sets serviced, as a precautionary measure

SPARTON 40

B-battery dead, or Heavy current drain on eliminator (if used)	1)	replace "shorted" 1-mfd. condenser used to by-pass screen of 438 power tube. Use 600-volt replacement
No AVC action	1)	try replacing '37 AVC tube first. If this does not cure trouble, check the 160-ohm resistor connected to r-f cathodes, chokes and ground

SPARTON 45

Inoperative	1)	type '45 tubes biasing resistor short-circuiting to chassis. Replace with a new 1,250-ohm, 10-watt unit
	2)	defective 10,000-ohm carbon resistor connected from the chassis to one side of the volume control. Replace with a wire-wound unit

SPARTON 47K

Weak reception, Cutting in and out	1)	faulty 6F7 combination i-f and 2nd-detector tube. Replace
Thin, rasping tone	1)	check audio grid bias voltages
	2)	poor voice coil connection. Resolder at cone

SPARTON 57

Inoperative (no plate voltage on any tube)	1)	"open" 1,000-ohm resistor between filter unit and plate 6D6 tube
Noise and poor reception	1)	check center connection on volume control. Resolder it carefully if necessary
Hum and whistling or squealing at resonance	1)	ground connection to shielding that covers 75 tube grid lead breaks away from its contact at the volume control. Resolder this connection
Hum (steady)	1)	loose connection in 1st detector coil. Resolder this connection carefully

SPARTON 57A, 57B

Hum and whistling or squealing at resonance	1)	ground connection to the shielding that covers the '75 grid lead often breaks away from its contact at the volume control. Resolder this connection carefully

SPARTON 61, 62

See also Case Histories listed for Sparton AC-63 receiver

Inoperative, Weak reception, Intermittent reception	1)	internal "short" in shielded grid lead running between 25Z5 and 43 tubes. Replace with a lead that can stand the heat under steady operation

(Cont'd)

SPARTON 61, 62—*(Cont'd)*

Distortion (tubes and voltages test O.K.)	1)	defective 5-mfd. section of filter condenser connected across speaker field and tapped filter choke (*yellow* lead coming out of condenser block)
Tunable squeal all over dial	1)	leaky 5-mfd., 165-volt section of filter condenser block. Replace with 8-mfd. 200-volt unit

SPARTON AC-62, AC-63

(Models which employ "Kardon" tubes)

Replacing tubes	1)	considerable saving in tube cost can be made by replacing old 401 tubes with newer quick-heater 485 tubes. This will increase sensitivity also. Mount 5-hole sockets directly above the old 4-hole ones, and wire in the heater circuit below the subpanel (being careful that the neutralizing condensers will open properly)

SPARTON 65, 65T, 66, 66T

Improving the selectivity (of early models only)	1)	remove *L-5* (Part *No. A-11041*) and install in its place new ***L-5*** **(Part *No. A-11535*)**. Remove *C-3* (Part *No. A-10973*) and install new *C-3* (Part *No. A-11474*). Connect one condenser across primary, and connect other one across secondary of *L-5*. Remove resistor *R-11* (Part *No. B-24334*) and install Part *No. B-5458-1* (a 2,200-ohm ¼-watt unit). Remove resistor *R-15* (Part *No. B-5458-33*) and install new 30,000-ohm ¼-watt unit Part *No. B-5458-31*
Whistling or squealing	1)	metal braid shielding on control-grid lead of type '78 tubes pushed back, leaving part of the lead unshielded. Shielding braid should cover full length of wire
Dial pointer does not turn	1)	loosen the front chassis screw so that the chassis will "float" on its rubber cushions
	2)	pinch (very carefully) the lugs which hold the drive assembly together. Use small pliers and pinch carefully—or the drive will run rough

SPARTON 67, 68, 68-XS

Inoperative	1)	"shorted" 0.2-mfd. 600-volt plate-return by-pass condenser *C-9*. Replace with a 0.2 or 0.25-mfd. 600-volt unit
Dial pointer does not turn (planetary drive slipping) (Model 67 receiver)	1)	pinch (very carefully with small pliers) the lugs which hold the drive assembly together. Do not overdo the pinching, or the drive will run too roughly
Mechanical vibration	1)	replace small pieces of rubber in middle of rear edge of chassis base plate with small strips of 1-inch masking tape along the edges of the plate, thereby preventing it from vibrating against chassis frame. Stick one end of tape to top side of plate, and fold other end around so it sticks to bottom

SPARTON 69

Inoperative, Weak reception	1)	trace the leads connecting low ends of r-f chokes to condenser block. Disconnect leads from block and test for continuity from the now vacant lug to chassis. A reading indicates this section shorted. Replace with a 125-mfd. 400-volt unit

SPARTON 69A

Weak reception, Broad tuning	1)	if difficulty is experienced in bringing the fourth band-pass filter in line with the others, proceed as follows: Give first, second and third selector trimmers 3 turns clockwise. Thus slightly less tuning capacity is necessary for a given frequency and the fourth trimmer can be brought into line with the others easily. If it is desired that the dial read in kc correctly as before, the compensation can be made by shifting the dial scale with respect to the shaft. The customary method may be employed for the balancing procedure by using an oscillator and output meter and re-adjusting the kilocycle scale on dial by loosening it on shaft and re-setting

SPARTON 71, 71B, 72

Noisy reception	1)	high-resistance connection to chassis caused by riveted joints at tube shields. Solder these in place

SPARTON 74

Inoperative (plate and screen voltage O.K.)	1)	"open" 200-ohm bias resistor in cathode circuits of r-f and i-f tubes

SPARTON 78

Same Case Histories as those listed for Sparton 71 receiver

SPARTON 79

Inoperative (no plate and cathode voltage on first and second r-f tubes. Proper voltages everywhere else)	1)	burned-out cathode choke between second and third r-f cathodes
Volume changes abruptly and erratically	1)	"leaky" cathode by-pass condenser allowing enough leakage current to reduce the bias on the tubes affected by the volume control. Replace with new 0.5-mfd. condenser

SPARTON 79A

Weak reception, Broad tuning	1)	see Case History listed for this trouble symptom under Sparton 69A receiver
Whistling or squealing "growl" while tubes heat up (when using 485's in r-f stages)	1)	arrange tubes with "quick-heaters" in first and second r-f sockets, using "slow-heater" tubes in third, fourth and fifth. If only one "quick-heater" is used, it may be placed in the detector socket

(Cont'd)

SPARTON 79A—*(Cont'd)*

Whistling or squealing	1)	high line voltage will often cause oscillation
	2)	adjust r-f trimmer condensers to give a band-pass effect
	3)	test 0.5-mfd. by-pass condensers in r-f section by substitution. Use 0.25-mfd. 400-volt units for any replacements
	4)	in models employing 485 tubes, if adjustment of trimmers to exact resonance is not effective in eliminating the oscillation, substitute a 0.25-mfd. 400-volt tubular condenser unit for the present 0.5-mfd. r-f amplifier plate by-pass condenser unit

SPARTON 80, 83, 84

Inoperative	1)	short-circuited 0.2-mfd., 200-volt condenser connected from the plate circuit of the AVC-controlled tubes to ground. Replace with a 600-volt unit
	2)	burned-out 3,000-ohm resistor (5,000-ohms in late-production receivers) as a result of overloading due to this condenser failure. Replace
Burning out of 3,000-ohm resistor Part *No. B-6061-8* (this is 5,000-ohm Part No. 6060-5 in receivers with later serial numbers)	1)	usually caused by failure of 2-mfd. 200-volt condenser, *C-8*, connected from plate of AVC-controlled tubes to ground. Replace resistor, and replace condenser with 600-volt unit
Improving tone of cabinet models	1)	remove screws holding speaker baffle in place. Insert ⅜-inch spacers under screws. Replace only the screws at the four corners for best results
Dial pointer does not turn (slipping of planetary drive)	1)	pinch very carefully, the lugs which hold the drive assembly together. Use small pliers and do not overdo the pinching, or drive will run roughly

SPARTON 85X, 86X

Improving tone of cabinet models	1)	remove screws holding speaker baffle in place. Insert ⅜-inch spacers under screws. Replace only the screws at the four corners for best results

SPARTON 89

Inoperative (no plate and cathode voltage on first and second r-f tubes. Proper voltages elsewhere)	1)	burned-out cathode choke between second and third r-f cathodes

SPARTON 89A

Inoperative	1)	"shorted" filter condenser section in power unit. Disconnect *red* lead to choke coil and connect new 2-mfd. 1,000-volt condenser between choke and ground

(Cont'd)

SPARTON 89A—*(Cont'd)*

Whistling or squealing	1)	high line voltage will often cause oscillation
	2)	try adjusting r-f trimmer condensers to give band-pass effect
	3)	test 0.5-mfd. by-pass condensers in the r-f section by substitution. Use 0.25-mfd. 400-volt units for any necessary replacements
	4)	in models employing 485 tubes, if readjustment of trimmers to exact resonance is not effective in eliminating the oscillation, substitute a 0.25-mfd. 400-volt tubular condenser for the 0.5-mfd. amplifier plate circuit by-pass unit

SPARTON 99

Inoperative (rectifier overheats and fuses blow)		check for breakdown of rubber insulation on the leads at the bottom of the power unit. They "short" to shield
Inoperative (no plate voltage on r-f tubes; low plate voltage on output tubes)	1)	primary winding "shorting" to secondary winding in 5th r-f transformer. Replace transformer
Intermittent reception, Fading	1)	r-f coil leads snapped at terminals
	2)	corroded band-pass tuner coupling pin
Weak reception, Distorted reception	1)	leaky 0.25-mfd. plate by-pass condenser in r-f amplifier
Weak reception (no grid voltage on det. tube)	1)	"open" detector grid choke located under amplifier near detector tube socket, and identified by *red* dot on bobbin
No control of volume	1)	leaky 1-mfd. cathode by-pass condenser
	2)	leakage between cathode and heater of types '484 and 485 tubes
Noisy tuning	1)	burrs on tuning condenser plates. Burn with high-voltage leads disconnected
	2)	defective first audio transformer. Replace with new unit or remove transformer and substitute resistance coupling in place

SPARTON 101

See also Case Histories listed for Sparton 99 receiver

Blasting, Poor tone, Whistling or squealing	1)	open-circuited 7,000-ohm bleeder resistor
	2)	bleeder resistor increased in value
Hum	1)	short-circuited 0.1-mfd. filter choke "tuning" condenser

SPARTON 103

Same Case Histories as those listed for Sparton 99 receiver

SPARTON 104

Noisy reception (tubes and voltages check O.K.)	1)	defective a-f transformer (even though it may test O.K.). Replace with new unit

SPARTON 104—*(Cont'd)*

Improving tone	1)	remove screws holding speaker baffle in place. Insert ⅜-inch spacers under screws, replacing only those at four corners
Dial pointer does not turn (planetary drive slipping)	1)	pinch (very carefully with small pliers) the lugs which hold the drive assembly together. Do not overdo the pinching, or the drive will run too roughly

SPARTON 109, 110, 111

See also Case Histories listed for Sparton 9-30 and Sparton 99 receivers

Whistle or "growl" while tubes are heating (when using 485's in r-f stages)	1)	arrange tubes with "quick-heaters" in first and second r-f sockets, using "slow-heater" tubes in third, fourth and fifth. If only one "quick-heater" is used, it may be placed in the detector socket

SPARTON 111A

Inoperative (no plate voltage, and continuity check reveals dead "short" between '81 filament and chassis)	1)	check filter condensers
	2)	check socket of choke fastened to side of cabinet. When plug is inserted, spring clips are spread apart and may come very close to rivets, causing a "short" to ground
Hum	1)	see remedy for this Trouble Symptom listed under Sparton 301 receiver

SPARTON 120

Whistling or squealing when set has warmed up	1)	increase value of by-pass condenser across the cathode resistor (using a condenser sufficiently large to produce complete stability)

SPARTON 140

To increase volume	1)	replace the 0.006-mfd. condenser connected from power transformer to ground with a 0.002-mfd. unit

SPARTON 193

Inoperative except when antenna is placed on stator of fourth r-f stage tuning condenser, resulting in reception of local stations only (all r-f coils, condensers and tubes test O.K.)	1)	open-circuited grid winding on one of the r-f band-pass coils
	2)	open-circuited soldered connection at one end of the coil connecting lugs. Resolder all connections at soldering lugs

SPARTON 210 Midget

Whistling or squealing after set warms up	1)	insufficient r-f cathode by-passing capacity. Connect a 0.1-mfd condenser across the small unit already connected in the circuit

SPARTON 235

Same Case Histories as those listed for Sparton 99 and Sparton 110 receivers

SPARTON 301

See also Case History listed for Sparton 99 receiver

Inoperative (no plate and cathode voltage on first and second r-f tubes. Proper voltages elsewhere)	1)	burned-out cathode choke between second and third r-f cathodes
Inoperative (slight hum)	1)	"open" 900-ohm 10-watt grid resistor in output tube circuit
Weak reception, Broad tuning	1)	see Case History listed for this same trouble symptom under Spartan 69A receiver
Hum	1)	poor contact in phono-pickup jack
	2)	push-pull tubes in this receiver must be matched very closely to prevent hum. Try several tubes in the output stage
	3)	poor connection between the case of the filter condensers and the frame of the chassis. Ground the case to the chassis with bonding braid
	4)	hum originating in r-f amplifier section may usually be eliminated by making a direct connection from the "ground" side of the amplifier to the ground of the power converter
Distorted reproduction, Weak reception	1)	dynamic speaker field coil connections reversed

SPARTON 333

Intermittent reception, Noisy reception	1)	open-circuiting stator connections under condensers. Replace with stranded wire pigtails
Intermittent hum, Fading	1)	poor ground connection at the eyelet of the type '42 output tube, due to a loose eyelet. Solder direct grounding wires from the heater circuit at this point and at all other points where grounding is dependent upon eyelets
Whistling or squealing at high-frequency end of dial	1)	50,000-ohm oscillator grid leak connected from grid to cathode of socket has increased in value. Replace with 40,000-ohm 1-watt unit
Reception of high-frequency code or police signals	1)	often due to breaking of wire which runs from antenna equalizing condenser to r-f section of condenser gang. Remove the broken wires and solder in a 6-inch length of flexible wire, allowing plenty of slack. If control-grid wire of 6F7 first-detector oscill. breaks, replace with a flexible wire long enough to run from grid cap down under gang condenser to the equalizer

SPARTON 400

Short-circuit between i-f tube plate and chassis	1)	breakdown of insulation in red shielded leads which connect the plates and r-f coils, causing the wire to short-circuit to the grounded shield. Replace these leads with heavily insulated unshielded wires

(Cont'd)

SPARTON 400—*(Cont'd)*

Noisy reception	1)	dust and other foreign particles between condenser-gang plates. Clean out with pipe cleaners and burn with high voltage (terminals disconnected) if trouble is not entirely removed
	2)	if noise is "intermittent," check for poor contact where r-f grid-return is connected to casting on bottom of coil. Solder a lead from this lug to ground

SPARTON 410

See also Case Histories listed for Sparton 9A and Sparton 420 receivers

Inoperative (no plate voltages on i-f tubes and oscillator)	1)	replace tubular condenser (attached to front panel) with a 0.5 or 1-mfd. 600-volt unit
Inoperative (fuse blows)	1)	faulty electrolytic filter condenser. Replace
Fading, Erratic tuning	1)	poor contact between one or more sections of the rotor plates to the condenser shaft. Drill and tap a hole through condenser sections into the rotor shaft of the plate and install a 6-32 screw for positive grounding
Intermittent reception	1)	check all by-pass condensers
	2)	loose connections on the resistor block. Resolder all connections
Microphonic howls, Fading	1)	check vitreous enameled voltage divider riveted to shielding panel. Rivets are used to secure the divider to the shield, also to make contact to the circuit lugs. To repair, solder resistor lugs to circuit lugs, also solder jumper to shielding. Since two of the divider terminals are insulated from the chassis, care should be exercised when soldering the lugs not to connect them to the shield panel
Whistling or squealing after warming up	1)	try two new 183 type tubes
Using '45 type power tubes	1)	'45 type power tubes may be substituted for the 183's by rewiring the output stage filaments in series, including a ½-ohm resistor in the circuit
To increase sensitivity of receiver	1)	replace 0.006-mfd. condenser connected between power transf. primary and ground with a 0.002-mfd. condenser of similar physical dimensions

SPARTON 420

See also Case Histories listed for Sparton 9 receiver

Inoperative	1)	insulated common B+ terminal shorting to chassis
	2)	r-f plate leads shorting to shielding braid
Intermittent reception	1)	loose connection on resistor block. Resolder all connections here
Noisy tuning	1)	burrs on tuning condenser plates. Burn with high voltage—all terminals disconnected
	2)	dust between plates
	3)	corroded rotor contacts. Bond rotors to condenser frame with flexible pigtails
Whistling or squealing	1)	corroded rotor contacts
Whistling or squealing (receiver checks O.K. otherwise)	1)	replace both type 183 tubes
	1)	dirty or corroded condenser-gang contacts. Clean contacts carefully or install flexible pigtails to rotor

SPARTON 467B

Whistling or squealing, accompanied by sudden drop in volume	1)	faulty 50,000-ohm resistor in the 6A7 oscillator tube grid circuit

SPARTON 478

Same Case Histories as listed for Sparton 71 receiver

SPARTON 485

Inoperative (little or no plate voltage)	1)	remove and replace screw at side tab of cylindrical condenser on rear left of amplifier can
Whistling or squealing, Howling, Motorboating sound (when first turned on)	1)	replace r-f and detector tubes. Tubes that are even slightly microphonic will cause this trouble if used in these stages

SPARTON 506

Speaker rattle	1)	cardboard tube separator resting against speaker cone. This should be removed
Microphonics	1)	remove wooden packing blocks from set

SPARTON 517

Distortion	1)	if condition clears up when finger is placed on grid cap of 75 tube, check for "leaky" by-pass condenser connected from junction of 220,000 and 100,000-ohm resistors in plate circuit of 75 tube

SPARTON 531

Inoperative (no r-f plate voltages on all or one tube)	1)	"short" between primary and secondary of one of the r-f amplifier coupling transformers
Excessive plate voltages, Erratic operation	1)	faulty 15,000-ohm bleeder resistor connected directly across the output of the filter

SPARTON 537

High noise level at all settings of volume control	1)	check i-f transformers (especially the primaries) for high-resistance "opens." Check by both "voltage" and "continuity" methods, as often one will not disclose the trouble, the other will
Noisy on one band	1)	check for "high-resistance" open in oscillator coil for band in question
Whistling or squealing when volume control is around mid-position	1) 2)	push control-grid lead of 6Q7G tube away from 6F6G output tube remove speaker cable wires as far away as possible from these two tubes

SPARTON 557

Same Case History as that listed for Sparton 517 receiver

SPARTON 564

Same Case Histories as listed for Sparton 99 receiver

SPARTON 567

Same Case History as that listed for Sparton 517 receiver

SPARTON 570, 574

Same Case Histories as those listed for Sparton 99 receiver

SPARTON 577

Same Case Histories as listed for Sparton 537 receiver

SPARTON 578

Same Case Histories as listed for Sparton 99 receiver

SPARTON 589

See also Case Histories listed for Sparton 99 and Sparton 531 receivers

Weak reception (low speaker field current)	1)	faulty 7,000-ohm resistor (with *brown* and *silver* ends) connected between primary of a-f transformer and ground
Weak reception (plate voltages on 484 low)	1)	"shorted" condenser located at rear and to left of amplifier unit. Replace

SPARTON 591

See also Case Histories listed for Sparton 99 receiver

Noisy	1) 2)	check all tubes for noisy operation noisy first a-f transformer primary. Check by replacing with another unit

SPARTON 593

See also Case Histories listed for Sparton 99 receiver

Broad tuning	1)	check wire connection between tuning condenser shield and chassis for a "break"

SPARTON 594

Inoperative	1) 2) 3) 4)	check 78 1st det.-osc. tube check 25Z5 tube. If it is burned out, replace filter condensers also "open" 100-ohm resistor in 2nd det.-avc. 75 tube cathode circuit faulty 0.5-meg. volume control

SPARTON 600, 610

See also Case Histories listed for Sparton 99 receiver

Volume suddenly increases to high value	1) 2)	"leaky" 0.2-mfd. cathode bias by-pass condenser in preselector stage this condenser intermittently "shorting" to shield of band-pass unit. Clear any such "shorts"
Reception cuts off suddenly and receiver is "dead"	1)	"open" voice coil pigtail connection
Reception cuts off suddenly and background noise remains	1)	primary winding of audio transformer short-circuits to core intermittently
Weak reception, Broad tuning at the lower frequencies	1) 2)	leaky by-pass condenser in the first type '484 tube cathode circuit. Replace with a 0.2-mfd. condenser if its terminal resistance is less than 10-megohms leads of band-pass coils snapped at lugs
Weak reception	1) 2)	leads of band-pass coils snapped at lugs high-resistance contacts between the socket prongs and tube prongs. Remove sockets and bend prongs back in shape. This is a result of rocking the tube while removing it from the tube socket, thereby bending the socket prongs

(Cont'd over)

SPARTON 600, 610—*(Cont'd)*

Hum, Distorted reproduction	1)	partially shorted dynamic spkr. field coil It's correct d-c resistance value is 5,000 ohms
	2)	weak, gassy, or unbalanced power output tubes
	3)	unbalanced push-pull input transformer secondary
Hum at resonance	1)	connect a 0.5-mfd. condenser from one side of power transformer primary to chassis. It is important that this condenser be of the non-inductive type
Squealing, Distorted reproduction	1)	open-circuited 15,000-ohm bleeder resistor
	2)	bleeder resistor increases in value
No control of volume	1)	"leaky" or "shorted" 0.2-mfd. cathode by-pass condenser in pre-selector stage
	2)	pre-selector stage cathode by-pass condenser grounding to shield
Motorboating sound	1)	check 1,250-ohm bias resistor on 183 output tubes. Replace with a wire-wound unit if it changes value during receiver operation

SPARTON 611

Same Case Histories as listed for Sparton 99 receiver

SPARTON 612

Same Case Histories as those listed for Sparton 600 receiver

SPARTON 617, 617X

Intermittent operation (audio end O.K. but i-f section cuts out)	1)	"shorted" i-f trimmer. Replace the mica with clear thin mica

SPARTON 620

Same Case Histories as those listed for Sparton 99 and Sparton 600 receivers

SPARTON 666M

Tubes run red hot	1)	check 6F6 output tube. If its emission gets low, the plate and grid bias voltages of the other tubes will be thrown far off normal, possibly causing their plates to run red hot. This causes damage to these tubes and possibly other parts of the receiver

SPARTON 676 Auto Radio

Inoperative	1)	check "A" lead connections for "opens"
	2)	check tubes—especially the 6K7 tubes
Receiver cuts out	1)	check the wiring at the socket of the 6K7 r-f tube. A *yellow* wire connects prongs *No. 5* (suppressor grid) and *No. 8* (cathode), and this wire passes under the soldering lug at prong *No. 7* (heater ground). If the lug is bent down too much, or if the *yellow* wire insulation is broken through, the *yellow* wire may be "shorted" (to ground). This will cause the set to cut out. This difficulty shows up as a defective type 6K7 tube, but the socket wiring should be checked carefully before condemning the tube

SPARTON 685

Inoperative	1)	"shorted" 0.2-mfd. 600-volt plate-return by-pass condenser *C-9*. Replace with 0.25-mfd. 600-volt unit if a 0.2-mfd. unit is not available

SPARTON 686 Auto Radio

Same Case Histories as listed for Sparton 676 Auto Radio receiver

SPARTON 691

See Case Histories listed for Sparton 67, 68 receivers

SPARTON 700

Erratic operation at one or more points when tuning dial is wiggled back and forth	1)	install pigtails on each individual condenser in gang
	2)	check condenser gang shaft for bent condition. Remove back plate on rear gang of condenser and reshape so shaft rotates more true

SPARTON 737 (Serial Numbers Below 6502)

See also Case Histories listed for Sparton 99 and Sparton 600 receivers

Design data	1)	two model 737 receivers have been marketed. One is finished in *black* and one is in *gold*. The *black* model uses an 80 rectifier and a pair of 183 power tubes. The high voltage is lowered from the original value supplied by the old type power transformer by means of a large *black* 1,200-ohm resistor located near the rectifier
Inoperative	1)	open-circuited 1200-ohm resistor located alongside of the type '80 rectifier tube
	2)	short-circuited primary or secondary power transformer windings. Repair or replace with new transformer
	3)	open-circuited type '80 or type 183 tube filament step-down resistors
	4)	audio transformer mounted so close to 183 tube next to it that it does not fit in socket properly, causing it to be forced to one side. Shift the transformer a bit more to one side
Low volume, Poor selectivity (low plate voltage and high plate current in fifth r-f tube)	1)	open-circuited secondary in fourth r-f coil. Resolder all the coil terminals to avoid future trouble
No control of volume, Intermittent fading	1)	"shorted" 0.2-mfd. condenser by-passing cathode bias resistor and volume control (condenser located at base of tube socket for pre-selector tuned r-f stage)

SPARTON 737 (Serial Numbers Above 6502)

See also Case Histories listed for Sparton 99 and Sparton 600 receivers

Inoperative	1)	open-circuited 13,000-ohm plate voltage dropping resistor
Inoperative (no filament voltage at either the 80 or 183 tube sockets)	1)	open-circuited filament resistors
Fuses blow	1)	power transformer breaking down

SPARTON 740, 750

See also Case Histories listed for Sparton 99

Intermittent reception	1)	intermittently open- or short-circuiting untuned r-f coil. Test carefully and replace any of the units which are found to be defective
	2)	nuts on grounding-strip bolts working loose. These should be tightened to insure uniform contact
Blasting, Poor tone, Whistling or squealing	1)	"open" 7,000-ohm bleeder resistor from r-f plate feeder to ground
	2)	bleeder resistor increased in value
Fading	1)	leaky cathode of by-pass condenser in pre-selector stage
	2)	pre-selector cathode by-pass condenser grounding to shield
Fading, Intermittent volume	1)	poor contact between band-pass pre-selector unit and r-f amplifier proper. Tighten spring in socket so that it makes good contact with the pin
Hum, Squealing, Distorted reception	1)	loose common terminal connection of filter condenser block
	2)	"open" 7,000-ohm bleeder resistor from r-f plate feeder to ground
Hum, Poor control of volume	1)	defective type 485 tubes, caused by short-circuited or loose elements. Test each tube by substitution, replacing if defective
No control of volume	1)	"shorted" 0.2-mfd. condenser by-passing cathode bias resistor in pre-selector r-f stage
	2)	pre-selector cathode by-pass condenser grounding to shield

SPARTON 766M

"Magic eye" not closing enough	1)	remove the 1.5-megohm, ¼-watt resistor connected to the green wire of the cable leading to the "magic eye" tube. This will cause a more pronounced movement of the "magic eye" shadow
Microphonics	1)	remove wooden packing blocks from set

SPARTON 835

Improving tone	1)	remove screws holding speaker baffle in place. Insert ⅜-inch spacers under screws, replacing only those at four corners

SPARTON 870

Noisy reception, Arcing	1)	terminal board on side of power unit (for connection of external choke) breaking down. Replace with new terminal or lead

SPARTON 871

Same Case Histories as listed for Sparton 99 receiver

SPARTON 900

Hum, Noisy reception	1)	poor contact between bottom of electrolytic condenser cans and chassis. Clean contacts thoroughly

SPARTON 913

Intermittent reception	1)	faulty primary winding in a-f transformer
Whistling or squealing	1)	connect 0.5-mfd. by-pass condensers from plate circuits to chassis in r-f box

SPARTON 930, 931

See also Case Histories listed for Sparton 99 receiver

Inoperative (no plate voltage on '84 tubes)	1)	check 110-ohm resistor located under terminal strip at rear of chassis. Replace with 100-ohm 1-watt unit if faulty
	2)	if the foregoing resistor is O.K., check tubular by-pass condenser in '84 section
Inoperative (Model 931 receiver only)	1)	if there is little or no r-f plate voltage on all or on one tube, check for "short" between primary and secondary of r-f amplifier coupling transformers
	2)	if plate voltages are low or zero, check for "shorted" by-pass condenser in plate circuit. Use 600-volt unit for replacement
	3)	check for "open" 1250-ohm resistor used to bias the two 182 tubes. Use 5-watt replacement unit
Weak reception (plate voltages on 484 low)	1)	"shorted" condenser located at rear and to the left of amplifier unit. Replace
Weak reception	1)	high-resistance connection at movable arm lug of tone control. Resolder this connection
Weak reception, Broad tuning	1)	see Case History for this same trouble symptom listed for Sparton 69A receiver
Weak reception with distortion (Model 931 receiver only)	1)	if plate voltage on power tube is low or zero, check for "open" 1,250-ohm bias resistor. Use a 5-watt replacement unit
Erratic operation (excessive plate voltages) (Model 931 receiver)	1)	faulty 15,000-ohm bleeder resistor connected directly across the output of the filter
Reception only between 850 and 1500 kc, (voltages and tubes test O.K.)	1)	cold soldered joint at first r-f plate choke
	2)	increase in value of 15,000-ohm bleeder resistor. Replace with new unit
Intermittent reception, Cutting off	1)	loose tuning condenser rotor section causing plates to rock slightly
	2)	corroded rotor contacts, causing high-resistance connection between rotor and condenser frame. Bond with flexible pigtails
Intermittent reception, Fading, Hum, Low volume (Model 930 receiver only)	1)	loose rotor plates in variable condenser
	2)	replace detector choke coil
Intermittent reception, Fading, Hum (Model 931 receiver only)	1)	increased value of 0.6-ohm hum-balancing control in power tube filament circuit (located between 182B power tubes.) Either replace the unit, or remove it from the circuit entirely if the hum is not too great without it
Intermittent reception and noisy (Model 931 receiver only)	1)	metal particles accumulated between plates of variable condenser. Blow out or burn out all foreign material

(Cont'd over)

SPARTON 930, 931—*(Cont'd)*

Double-spot reception, Whistling or squealing	1)	"worn" bearings on tuning condenser, causing plates to get out of alignment
Howling, Squealing, Motorboating sound (all while set warms up)	1) 2)	"open" secondary winding in one of r-f transformers check connections at r-f coils for corrosion
Squealing and distortion (Model 931 receiver)	1)	if plate voltages are also high and speaker field current is low, check 15,000-ohm bleeder resistor for increased value. Use 20-watt unit for replacement
Whistling or squealing after replacing type '485 tubes (tubes and voltages test O.K.)	1)	connect a 0.001-mfd., 600-volt condenser between the plate and cathode of the first r-f amplifier tube
Squealing or "growl" while tubes heat up when using 485's in r-f stages (Model 930 receiver)	1)	place "quick-heater" type tubes in first and second r-f sockets, using "slow-heater" in third, fourth and fifth
Howling at low volume	1)	replace r-f choke in 2nd det. plate circuit
Distortion, Inability to handle loud volume (Model 931 receiver)	1)	"shorted" cathode by-pass condenser in block mounted in base of external audio unit. Cut "shorted" condenser lead, and connect in a midget 0.1-mfd. 200-volt condenser across cathode resistor, tucking it in bottom of base
Distortion and whistling or squealing (Model 931 receiver)	1)	if plate voltages are also high, and speaker field current is low, check 15,000-ohm bleeder resistor for increased resistance. Replace with 20-watt unit
Hum between stations	1)	connect a 0.001-mfd., 600-volt condenser between one plate and the filament of the type '80 rectifier tube
Hum, Noisy reception	1) 2)	faulty contact of electrolytic filter condenser can to chassis poorly matched push-pull 182 tubes. Try several tubes (in various combinations) until suitable combination is found
Motorboating sound at reduced volume	1)	remove fibre cover from volume control. Smear small quantity of vaseline on carbon strip, working it in thoroughly with the roller

SPARTON 1068, 1078

Noisy reception	1)	resolder all connections to i-f coil *No. 14442-3*. Reassemble, and realign

SPENCER

SPENCER K (Midget receiver)

Inoperative (smoking and odor)	1) 2)	check filter condensers for "short" "shorted" winding in power transformer
Whistling or squealing	1)	check 0.5-mfd. r-f by-pass condenser for "open"
Noisy tuning	1)	clean rotor wiper contacts on tuning condenser

SPLITDORF

(See Case Histories listed under EDISON)

STEINITE

STEINITE 70, 80 (Chassis No. 10)

Inoperative, Tubes blow.	1) 2)	rotting of rubber insulation on 5-wire speaker cable, causing short-circuits. Replace with new cable defective screen and plate supply by-pass condensers. Replace with 0.5-mfd. units
Replacing 483 power tubes with 45's	1)	remove bias resistor from center lead of power transformer. Transfer one of the filament wires from outer tap to which it is normally connected, to the *center* tap. Remove old hum-balancing potentiometer, and install 20-ohm center-tapped resistor across filament circuit in its place. Connect opened end of bias resistor to midpoint

STEINITE 95 (Chassis No. 10)

Inoperative, Tubes blow	1) 2)	rotting of rubber insulation on 5-wire speaker cable, causing "shorts." Replace cable faulty screen and plate by-pass condensers. Replace with 0.5-mfd. units

STEINITE 421, 425 (Chassis No. 21)

Inoperative	1) 2) 3)	"open" primary in push-pull input transformer "shorted" 1-mfd. condenser in cathode circuit of first audio tube if screen voltage is low or absent, check for "shorted" tubular 0.1-mfd. condenser (all three). Also see that "shorted" condenser has not damaged the screen bleeder resistor

STERLING

STERLING F

Reception cuts off	1)	faulty volume control. Replace
Hum	1)	increase bias on 45 output tube by inserting a 1,500-ohm 10-watt resistor in series with speaker field

STERLING G

Power transformer smokes, Fuses blow	1)	short-circuited power transformer primary. Replace transformer coil or entire unit

STEWART-WARNER

Chassis Wiring Color Code Used on Stewart-Warner Receivers

In order to simplify the tracing of wiring, the following color code is being used for the chassis wiring of all recent Stewart-Warner receivers. Every effort is made to follow this code, though occasionally exceptions must be made.

(Cont'd)

STEWART-WARNER—Chassis Wiring Color Code—*(Cont'd)*

Green ——— Grid
Yellow ——— Plate
Orange ——— Cathode
Green & White ——— The avc diode and avc circuit
Green & Black ——— Detector diode
Blue ——— Ungrounded heater or antenna
Black ——— Ground, grounded heater and grounded B minus
Brown ——— Ungrounded B minus
Red & Blue ——— B plus (filter input) usually over 300 volts d.c.
Red ——— Normal B plus, usually 200 to 300 v.
Red & White ——— Intermediate B plus, about 100 to 250 v. other than screens
White ——— B plus, about 100 volts (on screens only)

STEWART-WARNER (All Models)

By-pass condensers breaking down frequently ——— 1) working voltage rating of original by-pass units is 400-volts. Change all to 600 working voltage units

STEWART-WARNER AC-DC Receivers (A11)

Filter condensers and rectifier tubes fail prematurely ——— 1) when certain power line impedances exist, extremely high surge voltages may be developed across the filter condenser of an ac-dc receiver. These voltages may be as high as 300-volts, and occur only if the set is turned off on a particular part of the a-c cycle of the power-line current. Such a surge often punctures the filter condenser, and this causes the rectifier tube to fail. Since this difficulty is caused by a power-line condition, if it happens once in a certain customer's home, it is very likely to happen again.

The Stewart-Warner Engineering Department has developed a simple remedy for this trouble, and it is being incorporated in all recent Stewart-Warner AC-DC receivers

The service man can easily apply it to other existing receivers. The remedy is to insert an inexpensive 50-ohm 1-watt resistor in series with the connection from the rectifier-tube cathodes to the first electrolytic filter condenser

STEWART-WARNER Year 1939 Receivers

General service note regarding ground connection on new type octal sockets ——— 1) when tracing the wiring in Stewart-Warner 1939 radio chassis, it will be found that apparently certain socket terminals are not connected to ground, even though the circuit diagram shows a ground connection. Actually such terminals are connected to a common grounding lug which is located between the two bakelite wafers of the socket. It is important to remember this fact when tracing the circuit wiring since if you do not know of these internal connections, the circuit wiring may seem to be incomplete

Sockets with the internal connections can be identified by the grounding lug extending from the side of the socket. In the chassis this lug is always grounded. For most tubes, the terminals connected to the grounding lug are the *cathode*, one side of the *heater* and the *shield* connection

(Cont'd)

STEWART-WARNER Year 1939 Receivers—*(Cont'd)*

General service note regarding ground connection on new type octal sockets —*(Cont'd)* Most of the Stewart-Warner 1939 A.C. receivers use one or more of these special sockets, employing them wherever all three of the above terminals are to be grounded to the chassis. Of course, any wiring or other parts connecting to any of these three socket terminals are thus grounded by the internal socket connector

STEWART-WARNER "COMPANION" A.C.-D.C.

Excessive hum, Poor sensitivity ——— 1) leakage between the condenser block and chassis, caused by the soaking through of the liquid through the cardboard container. Wrap a layer of thick waxed paper around the condenser block and replace it in the chassis (*Note*: "Empire" cloth will be even more satisfactory)

STEWART-WARNER Chassis 01-5D (used in Models 01-5D9 and 01-5D9-WT)

Service Note: ——— 1) when the chassis is removed for servicing, the phonograph pickup cable must be plugged in and the "Radio-Phono" switch placed in the "Radio" position before the receiver will operate

STEWART-WARNER Models 01-5D9 and 01-5D9-WT

See Case Histories listed for Stewart-Warner Chassis 01-5D

STEWART-WARNER Model 01-5H

Weak, erratic reception (screen of 6F6G output tube glows) ——— 1) check output transformer
2) "leaky" or "shorted" 14-10-mfd. dual electrolytic condenser

STEWART-WARNER Model 01-6B9

Excessive needle scratch during phono operation ——— 1) check the phonograph pick-up connections at the "Phono-Radio" switch under the top panel as described below:

First samples of this receiver had a 220,000-ohm resistor across the pick-up connections. In these sets, remove the 220,000-ohm resistor and connect a 68,000-ohm resistor (or 70,000-ohm if no 68,000-ohm unit is available) across the pick-up. Then connect a 0.003-mfd. condenser across this shunt resistor.

A few sets had the 68,000-ohm resistor connected across the pick-up, but no 0.003-mfd. condenser. In these sets, add the 0.003-mfd. condenser across the pick-up connections. Most sets will have a 68,000-ohm resistor and a 0.003-mfd. condenser connected across the pick-up. These sets should not be changed but if there is excessive needle scratch, make sure the 0.003-mfd. condenser is not open-circuited.

Some sets using a slightly different pick-up have a 470,000-ohm resistor and a 0.001-mfd. condenser connected across the pick-up. These should not be changed, although a slightly larger condenser would cut the high notes more and such a condenser could be used if the customer prefers the tone quality with the larger condenser.

"Growling" during phono operation ——— 1) be sure chassis hold-down bolts are loosened sufficiently to permit the radio chassis to float on its rubber cushions
2) if it is a very early chassis, make the resistor-condenser change explained in the first part of this Case History
3) if the growl is not removed by the foregoing, replace the 22,000-ohm resistor connected to the tap of the volume control with a 47,000-ohm resistor

STEWART-WARNER Chassis 01-6C and 010-6CX (used in Models 01-6C9 and 010-6C9X respectively)

Improving tone —especially at high vol.	1)	if chassis contains a 22,000-ohm unit for resistor *No. 31*, tone will be improved if it is replaced by a 47,000-ohm resistor
Improving tone when records are being played	1)	if either the 220,000-ohm resistor, or the 0.001-mfd. condenser (which should be found connected across the pickup) are missing, or are of a value different from that specified, replace them with units of the proper values
"Growling" during phono operation	1)	be sure the receiver chassis and record changer mechanism hold-down bolts are loosened sufficiently. To eliminate these growls remove the two *red* shipping bolts holding down the record changer mechanism. These bolts are accessible from the rear of the cabinet and are located on both sides of the mechanism. Also loosen the three bolts holding down the chassis, so that their heads no longer touch the wood, and the chassis floats freely on the rubber bushings. Make sure that shafts of controls do not bind on the cabinet
Audio whistles	1)	whistles in a receiver having a chassis stamped with the letter "S" are caused by feedback in the tone control circuit. To eliminate this difficulty, so that the *red* lead from the tone control switch is kept away from the other leads of that cable. Also make sure that the 0.01-mfd. condenser *No. 34*, located at the tone control switch, is kept as far as possible from the cable

STEWART-WARNER Models 01-6C9 and 010-6C9X

See Case Histories listed for Stewart-Warner Chassis 01-6C and 010-6CX respectively

STEWART-WARNER Chassis 01-81 (used in Models 01-811 to 01-819)

Hum	1)	check to see if the 6F6G grid resistor (*No. 23*) is a 470,000-ohm unit. If so, replace this resistor with a combination made up of a 220,000-ohm and a 100,000-ohm resistor connected in series (with the 220,000-ohm unit going to the 6F6G grid). Connect a 0.02-mfd. 400-volt condenser between the junction of these two resistors and the chassis (*ground*)

STEWART-WARNER Models 01-811 to 01-819

See Case Histories listed for Stewart-Warner Chassis 01-81

STEWART-WARNER 02-4C1, 02-5T1, 02-428, 12-4D1, 205CA, 205CK

Vol. control knob hard to turn	1)	file burrs off vol. cont. shaft arm, and off slider located under dial scale. Put vaseline on sliding parts

STEWART-WARNER Chassis 03-5R (used in Models 03-5R, 03-5R4, 03-5R5, 03-5R6, 03-5R7)

Increasing sensitivity	1)	in locations where additional sensitivity is necessary, these wood cabinet models can be stepped up by introducing a slight amount of regeneration in the i-f stage. Make change as follows: Disconnect the 0.05-mfd. condenser *No. 28* from the suppressor grid terminal of the 12SK7 socket. In the Underwriters approved sets (Model 03-5R, etc.) connect it instead to the B— terminal of the volume control. This is the terminal nearest the 12SQ7 socket, and is clearly indicated in the tube socket voltage layout of the service manual. In non-approved models (07-5R, etc.) connect condenser *No. 28* to ground. After the condenser change has been made, realign the receiver. It is especially important to readjust trimmer *No. 9* (the broadcast oscillator padder) exactly as explained in the service manual. When aligning, keep the chassis away from the loop, or oscillation may occur. This change cannot be made on any of the plastic cabinet 5R sets (03-5R1, 03-5R3, etc.). The plastic cabinet sets of this series will oscillate if they are stepped up beyond the present limit of sensitivity by this means.

(Cont'd)

STEWART-WARNER Chassis 03-5R (used in Models 03-5R, 03-5R4, 03-5R5, 03-5R6, 03-5R7)—(*Cont'd*)

Increasing sensitivity —(*Cont'd*)		from the suppressor grid terminal of the 12SK7 socket. In the Underwriters approved sets (Model 03-5R, etc.) connect it instead to the B— terminal of the volume control. This is the terminal nearest the 12SQ7 socket, and is clearly indicated in the tube socket voltage layout of the service manual. In non-approved models (07-5R, etc.) connect condenser *No. 28* to ground. After the condenser change has been made, realign the receiver. It is especially important to readjust trimmer *No. 9* (the broadcast oscillator padder) exactly as explained in the service manual. When aligning, keep the chassis away from the loop, or oscillation may occur. This change cannot be made on any of the plastic cabinet 5R sets (03-5R1, 03-5R3, etc.). The plastic cabinet sets of this series will oscillate if they are stepped up beyond the present limit of sensitivity by this means.

STEWART-WARNER Models 03-5R, 03-5R4, 03-5R5, 03-5R6, 03-5R7

See Case Histories listed for Stewart-Warner Chassis 03-5R

STEWART-WARNER Chassis 03-6N

Hum	1)	change value of audio blocking condenser (*No. 33* in circuit diagram) connected from arm of volume control to the 6SQ7 grid. Change from 0.004-mfd. to 0.04-mfd. Then connect a 40-mfd., 150-V. electrolytic condenser across the electrolytic condenser (*No. 55B* in circuit diagram) connected from B-plus to speaker field

STEWART-WARNER 05-5L1

Inoperative	1)	check filter condensers. Replace

STEWART-WARNER Model A-6 (Air Pal)

See Case History listed under Stewart-Warner Chassis 07-31

STEWART WARNER 6C9

Automatic record changer motor inoperative	1)	corroded a-c connections inside of motor. Clean and resolder

STEWART-WARNER Chassis 07-31 (used in Model A-6 Air Pal)

I-f oscillation when aligning the receiver	1)	keep the bottom cover plate on during alignment
	2)	keep the signal generator leads as far from the chassis as possible in order to prevent unnecessary feedback
	3)	connect the ground lead of the signal generator through a 0.25-mfd. condenser to some part of the chassis in the *vicinity of the gang condenser*
	4)	keep the *orange* lead of the volume control away from the 2nd i-f transformer. Separating this lead from the others surrounding it at the base of the 25B8GT tube will also help

STEWART-WARNER Chassis 07-5R (used in Models 07-5R 07-5R4, 07-5R5, 07-5R6, 07-5R7)

See Case Histories listed for Stewart-Warner Chassis 03-5R

STEWART-WARNER Models 07-5R, 07-5R4, 07-5R5, 07-5R6, 07-5R7

See Case Histories listed for Stewart-Warner Chassis 03-5R

STEWART-WARNER Chassis 07-51 (used in Models 07-511 to 07-519)

Hum, Noise
1) try reversing line plug. If hum still persists, remove connector between terminals *A* and *A*, on back of chassis. Connect an external antenna to term. *A*

Resistor #17
1) when replacing 33-ohm resistor *No. 17* (connected in parallel with the pilot light) use a 3-watt molded wire-wound resistor instead of the original ½-watt type. This will protect this resistor in the event of pilot lamp failure

STEWART-WARNER Models 07-511 to 07-519

See Case Histories listed for Stewart-Warner Chassis 07-51

STEWART-WARNER Chassis 08-81 (used in Models 08-811 to 08-819)

See Case History listed for Stewart-Warner Chassis 01-81

STEWART-WARNER Models 08-811 to 08-819

See Case History listed for Stewart-Warner Chassis 01-81

STEWART-WARNER Models 10 to 20

See Case Histories listed under Stewart-Warner Chassis R-108, R-108X

STEWART-WARNER Chassis 010-81 (used in Models 010-811 to 010-819)

See Case History listed for Stewart-Warner Chassis 01-81

STEWART-WARNER Models 010-811 to 010-819

See Case History listed for Stewart-Warner Chassis 01-81

STEWART-WARNER Models 11-6V9, 11-7A8, 11-7A9, 11-8D6, 11-8D7, 11-8D8, 11-8D9, 11-8D6-Z, 11-8D7-D, 11-8D8-Z, 11-8D9-Z

Record changer does not go into changing cycle at end of record
1) if "stop" groove in record is worn out or damaged, discard the record
2) *Out-Of Adjustment May Be Incorrect*: The Record Changer should go into its changing cycle when the needle enters the stop groove and has traveled to within a distance of 1⅞" from the center of the turntable shaft.

If the Record Changer does not go into its changing cycle when the needle has reached the above mentioned distance, the Tone Arm Trip Lever Shoe *23* should be moved toward the outside edge of the panel. To do this, it is necessary to loosen the thumb nut *22* and then retighten after adjustment has been made.

If the Record Changer goes into its changing cycle before the needle has reached a distance of 1⅞" from the center of the turntable, the Tone Arm Trip Lever Shoe should be moved *inward* toward the center of the Record Changer.

(Cont'd)

STEWART-WARNER Models 11-6V9, 11-7A8, 11-7A9, 11-8D6, 11-8D7, 11-8D8, 11-8D9, 11-8D6-Z, 11-8D7-D, 11-8D8-Z, 11-8D9-Z—*(Cont'd)*

Record changer does not go into changing cycle when switch knob is turned to "On"
1) make sure motor is running
2) check Trip Rod *32* to make sure it releases Trip Lever Assembly *20* from Engagement Clutch Cam Assembly *79* when Switch Knob is being turned on. If Trip Lever Assembly is not released, Trip rod should be shortened by bending until Trip Lever clears Engagement Clutch Cam Assembly, when Switch Knob is turned.

Make sure that Clutch Reset Pawl *40* clears Drive Link Assembly *31*.

Record changer continues to repeat its changing cycle without playing records
1) trip Lever Assembly *20* does not latch in Engagement Clutch Cam Assembly *79* which may be due to causes listed below:

a) Trip Rod *32* may be bent so that it is too short, holding Trip Lever Assembly from contacting Engagement Clutch Cam Assembly.

b) Springs *24* or *35* may be disconnected.

No sound when needle is on moving record
1) "muting" switch *26* may be out of adjustment. The contacts of this switch should be *open* whenever its long blade is not resting on the shoe of the Engagement Clutch Cam Assembly *79*. If the contacts remain closed after the long blade has left the shoe, they should be adjusted by bending until there is a separation of approximately 1/32".
2) switch should be checked to make sure contacts are closed when long blade is resting on the shoe of the Engagement Clutch Cam Assembly.
3) the lugs on the Muting switch may have been bent together.
4) pickup cartridge in Tone Arm may have been damaged or may be defective.

Tone arm lowers on record too suddenly
1) Spring Washer *50* which is located between Tone Arm Lifter Link Assembly *81* and Selector Shaft Crank Assembly Post *7* is not under sufficient pressure. The setscrews in the Selector Shaft Collar *6* should be loosened and the Selector Shaft Collar pressed upward slightly and set screws tightened

Needle drags across record
1) if the needle drags across the record, the long portion of the Tone Arm Lever Assembly *19* is contacting the pin on the top side of the gear assembly *4* and is being moved by it. The remedy is to bend the long portion of the Tone Arm Lever Assembly upward so that it clears the pin. In some radio models the lever may be reached without removing the record changer from the cabinet; however, if easy access is not possible, removal of the complete record changer is recommended

Tone arm lands improperly on both 10" and 12" records
1) if the Tone Arm lands improperly on one size of record but properly on the other size, the Tone Arm adjustments for 12" or 10" records, previously described, should be made. Improper landing on *both* 12" and 10" records is due to a dislocated Tone Arm. This may be remedied by loosening the screw located on the Tone Arm Swivel Bracket *46* and moving the Tone Arm to the proper position and then retightening the screw. A rough check as to the proper position is to place the Tone Arm in its rest position and see if the outside of the Tone Arm is flush with the edge of the Motorboard. The two set-screws on the Tone Arm Shaft *77* should be checked to see if they are tight

STEWART-WARNER 11-10A, 11-10A-Z Chassis

Audio howl
1) chassis must be allowed to float on the rubber mounting grommets. Loosen the four mounting bolts which hold the

(Cont'd over)

STEWART-WARNER 11-10A, 11-10A-Z Chassis—*(Cont'd)*

Audio howl —*(Cont'd)*		chassis, and also remove the wooden strips which may have been used for shipping. See that the knobs, shafts, and dial mechanism do not touch the cabinet. On chassis not stamped with a letter "S", a tendency to howl or rumble may be stopped by changing the value of 0.01-mfd. audio coupling condenser *No. 60* (connected between the diode load resistors and the radio-phono push-button key) to 0.002-mfd. Replacing the rear rubber grommet on the gang tuning condenser with a soft gum rubber type will clear up the last bit of this trouble. The washers and mounting bolt should not be replaced if this is done

STEWART-WARNER Models 11-10A6, 11-10A6-Z, 11-10A8, 11-10A8-Z, 11-10A9, 11-10A9-Z, 11-10A10, 11-10A10-Z

Same Case Histories as those listed for Stewart-Warner Model 11-6V9 receiver

STEWART-WARNER 12-4D Chassis

Whistling or squealing	1)	see that antenna and ground wires are pulled straight out from the set, and that they do not pass close to the tubes

STEWART-WARNER "Hudson" DB-40, SA-40 Auto Radios

See Case Histories listed under Hudson DB-40, SA-40 receivers

STEWART-WARNER Models 50 to 59

See Case Histories listed for Stewart-Warner Series R-105

STEWART-WARNER Chassis 91-62 (used in Models 91-621 to 91-629)

Sensitivity poor, Tuning eye does not operate	1)	liquid leaks out of electrolytic condenser and partly "shorts" avc system. Check this, and clean off all traces of electrolyte. Replace condenser

STEWART-WARNER Models 91-621 to 91-629

See Case History listed for Stewart-Warner Chassis 91-62

STEWART-WARNER Chassis 91-64 (used in Models 91-641 to 91-649)

Removing chassis	1)	when the phono pickup leads are disconnected in order to remove this chassis from cabinet for testing or repairs, the set will not operate unless the two outside terminals at the phono terminal strip are connected together, and the center terminal is grounded to the chassis
Distortion, Low sensitivity	1)	check value of grid resistor (*No. 24* in circuit diagram). If it is lower than 10-megohms, replace it. (Due to the particular circuit employed, the triode section of the 6Q7G operates at *zero* grid bias)

STEWART-WARNER Models 91-641 to 91-649

See Case Histories listed for Stewart-Warner Chassis 91-64

STEWART-WARNER Chassis 97-56 (used in Models 97-561 to 97-569)

To increase sensitivity	1)	a special sensitivity control trimmer will be found on the back of the set so that it can be adjusted for maximum sensitivity with the particular aerial being used with it. The adjustment should be made with the aerial connected to the set. This sensitivity control is the center trimmer condenser of the three mounted on the back of the chassis. In most receivers, a hole is provided in the center of the back of the receiver cabinet, so that this trimmer screw may be reached easily without removing the back. In some of the sets, no hole is provided, and in these sets, the back must be removed to adjust this trimmer. To adjust the sensitivity control, proceed as follows: Connect the receiver to the aerial and tune it to a fairly weak station preferably at the low-frequency end of the dial. Set the volume control so that the volume is fairly low. Using an insulated screwdriver turn the sensitivity control trimmer clockwise. The sensitivity will increase up to a certain point at which the set will begin to squeal. Turn the screw back until the squeal disappears and the tone quality is good. In making this adjustment, keep turning the volume control down so that the set will not overload, as you may confuse the overloading with oscillation. Check operation of the set over the entire dial scale with the volume control turned to *maximum* volume position. Of course, under this condition many of the stations will be badly distorted because of overloading. If there is oscillation squealing on any part of the dial, turn the trimmer slightly to the left (counter-clockwise)

STEWAWRT-WARNER Models 97-561 to 97-569

See Case Histories listed for Stewart-Warner Chassis 97-56

STEWART-WARNER Chassis 97-57 (used in Models 97-571 to 97-579)

Squealing	1)	if receiver squeals when volume control is advanced, separate the 6Q7G grid lead from the speaker wires as much as possible by pulling the grid lead to the side of the 6Q7G nearest the tuning condenser
Heterodyne whistle when tuning in stations	1)	i-f stage oscillating. Move the lead from the 6A8G cathode to the 6Q7G cathode as close to the chassis and as far from the other wires as possible. It may be necessary also to connect a 0.05-mfd. 200-volt condenser to whichever one of the foregoing cathode terminals does not already have such a condenser connected to it

STEWART-WARNER Models 97-571 to 97-579

See Case Histories listed for Stewart-Warner Chassis 97-57

STEWART-WARNER R-100A, R-100B, R-100E

Set dead, Excessive hum	1)	defective 0.25-mfd. condenser in cathode circuit of detector tube
	2)	defective speaker field resistor
	3)	defective filter condensers
Intermittent reception (low r-f tube plate voltages)	1)	defective smaller section of the wire-wound resistor under the condenser can. Replace with a 1,000-ohm, 10-watt unit
Weak reception, Low voltage on tubes	1)	replace the *red* 45,000-ohm, 1-watt carbon resistor connected between the r-f plates and the ground with a 2-watt unit

(Cont'd)

STEWART-WARNER R-100A, R-100B, R-100E—*(Cont'd)*

Distortion	1)	leaky 0.1-mfd. coupling condenser between the type '27 detector tube plate choke and the grid of the first audio tube
Noisy reception	1)	due to volume control. Connect a 0.25-mfd., 200-volt condenser between the low potential side of the antenna coil and the ground
Volume control burns out	1)	faulty 20,000-ohm 3-watt bleeder resistor connected between the screen circuit and the voltage divider. Measure the voltage existing across the volume control. If it is greater than 70-volts, replace this bleeder resistor
Squealing at low-frequency settings of tuning dial	1)	clean tuning condenser rotor contact clips and bend them to increase the pressure. If necessary, solder flexible pigtails between the shaft and the springs
	2)	replace the second r-f tube with a type '35 or '51 tube
Squealing at high-freq. end of dial	1)	check for "open" 0.25-mfd. 400-volt r-f plate by-pass condenser located close to r-f tuning coils
	2)	increase the value of the screen-grid resistor by-pass condenser to about 0.5-mfd.
	3)	also reduce screen voltage if necessary
Squealing, Distortion	1)	replace 0.25-mfd. 200-volt r-f grid by-pass condenser
	2)	if set squeals when quick-heater tubes are used, replace the 0.1-mfd. screen by-pass condenser with a 0.5-mfd. (or higher) capacity—(200-volt)
Squealing (accompanied by abnormally high voltages)	1)	replace 20,000-ohm *orange* colored resistor in center of resistor mounting board

STEWART-WARNER Models R-102A, R-102B, R-102E

Intermittent operation, Fading (accompanied by a buzz)	1)	100,000-ohm (color code *brown, black, yellow* resistor changes value). Replace it even if voltages, etc. check O.K.
Intermittent operation	1)	check toggle switches for faulty contacts
Weak reception, Distortion	1)	check for faulty 0.1-mfd. 400-volt condenser connected between the *purple* and *yellow* resistors on the resistor strip in the '24 det. tube plate circuit
	2)	check for faulty 0.02-mfd. 400-volt detector audio coupling condenser
	3)	faulty 2-megohm second detector screen grid resistor
Squealing all over dial (voltages check O.K.)	1)	open-circuited 0.1-mfd. by-pass condenser across 500-ohm cathode series resistor in the type '51 tube circuit. Replace with new unit
Intermittent hum (slight jar brings set back to normal when hum starts)	1)	low end of type '47 tube grid resistor short-circuiting to chassis

(Cont'd)

STEWART-WARNER Models R-102A, R-102B, R-102E—*(Cont'd)*

Intermittent distortion (accompanied by slight hum increase)	1)	faulty 250,000-ohm resistor in 47 tube grid circuit (between *yellow* speaker wire and another resistor and condenser)
Distortion on strong signals	1)	try several different values of '24 det. cathode resistor (original is 45,000 ohms) as this value is often critical
Dial slips	1)	remove rubber drive wheel. Wind one layer of rubber or friction tape on its shaft. Replace

STEWART-WARNER Series R-105 (Models 50 to 59)

No short-wave reception	1)	short-circuited trimmer condenser in short-wave detector plate circuit
Weak reception with the local-distance switch in the "local" position	1)	realign the broadcast gang trimmers with the switch in the "local" position
Noisy, Intermittent reception	1)	corroded contacts on wave-band switch
Fading	1)	open-circuited 2-megohm AVC tube grid resistor
Broadcast interference on short-waves	1)	de-tune center short-wave i-f trimmer (counter-clockwise)
Microphonic	1)	loose chassis-mounting bolts
Poor tone	1)	tone can be improved in all chassis stamped with letter "A" on rear by removing the 0.02-mfd. condenser connected from plate of 57 AVC tube to ground and replacing it with a 0.25-mfd. 200-volt unit

STEWART-WARNER Series R-106

Fading	1)	defective type '47 tube

STEWART-WARNER Chassis R-108, R-108X (used in Models 10 to 20)

Low volume	1)	change in value of type '36 detector tube plate resistor. Replace with 2.1-megohm, 0.25-watt unit
	2)	defective type '36 detector tube cathode resistor and by-pass condenser. Replace both units
	3)	replace the type '38 power amplifier tube (even though it may test O.K.)
Distortion	1)	detector characteristics of '36 tube used in these receivers is very critical. The '36 det. tube in the receiver may no longer operate satisfactorily as a detector for the receiver (even though it tests O.K.) Select another detector from a number of '36 tubes by trial

STEWART-WARNER Chassis R-110

Stations "plop" in suddenly as tuning dial is turned	1)	change AVC resistor in grid-return lead of r-f tube from 200 ohms to 50,000 ohms

(Cont'd over)

STEWART-WARNER Chassis R-110—*(Cont'd)*

Squealing all over dial	1)	tighten rotor connections or pigtails on tuning condenser. Run a separate direct ground to chassis from each individual section of the gang condenser
Loud crackle when set is first turned on	1)	in early model receivers this noise is normal and is caused by electrolytic condenser film breaking down on high starting voltage surges. The film quickly re-forms

STEWART-WARNER Chassis R-111

Tunable hum	1)	"open" 0.02-mfd. 600-volt paper condenser *No. 15* in control-grid return circuit of 6B7 2nd det.-amp.-avc tube. Do not replace with a wax or tar-filled unit, as heat from '43 tube will cause this compound to run between the plates of the tuning condenser

STEWART-WARNER Chassis R-112 (used in Models 1121, 1122, 1123) Auto Radio

Engine noise after standard suppression devices have been installed	1)	shield (in a single metal-braid shield) the two control cables and the dial light wires from the tuning head to the chassis. Ground the shield at both ends
Vibrator "hash" (present even when car engine is stopped)	1)	remove chassis from metal cabinet and with heavy iron, solder top of transformer-vibrator housing to sides, running a ring of solder clear around all four sides. See that bottom cover is soldered to side at least at one point. If this fails to remove hash, add two 0.25-mfd. condensers across vibrator contacts. To do this remove two self-tapping screws holding housing to bottom cover, break solder seal at bottom of housing with hammer and screw driver, not an iron. Force screwdriver between housing and bottom cover at screw holes to break away burr formed by screws. Place block of wood against upper edge of housing and knock it loose with hammer. Connect new condensers across each of outside terminal strips, grounding the other end of each. Place one in vertical position alongside transformer winding directly opposite r-f choke. Place the other in a horizontal position between bottom of transformer winding and legs of transformer bracket. (Model R-112 receivers with rubber vibrator housing already have soldered tops and 0.25-mfd. condensers)
	2)	if motor noise is extremely bad, try slipping grounded braided shielding over tone control wire and the dial light wire. These two wires are enclosed in one cable which runs from the receiver to the tuning head
Buzzing, Rattling	1)	vibration of loose paper in the chassis. Glue this paper to the side of the chassis from which it has become detached
To increase volume and improve tone	1)	disconnect B plus (*yellow* and *red* lead) from side of output transformer from screen grid terminal of output tube and connect it to the high-voltage side of the combination relay and filter choke. The most convenient point to connect is the cathode terminal of the rectifier

(Cont'd)

STEWART-WARNER Chassis R-112 (used in Models 1121, 1122, 1123) Auto Radio—*(Cont'd)*

To increase volume and improve tone —*(Cont'd)*		tube. This raises plate potential about 40 volts. Change the grid resistor of the '41 from 510,000 ohms to 250,000. It is enclosed in a piece of large spaghetti and is connected from the '41 grid to ground. Change the permanent tone control condenser which is connected to the plate of the output tube from 0.01 to a 0.006-mfd. 600-volt unit. It may be necessary to readjust the spring of the relay as output tube plate current no longer passes through it. Reduce the tension of the relay spring, which tends to keep the contacts closed, by stretching it slightly

STEWART-WARNER Chassis R-115

Tunable hum	1)	"open" 0.02-mfd. 600-volt paper condenser *No. 15* in control-grid return circuit of 6B7 2nd det.-amp.-avc tube. Do not replace with a wax or tar-filled unit, as heat from '43 tube will cause this compound to run between plates of the tuning condenser
Motorboating sound, Whistling or squealing,	1)	check 6.3-volt pilot lamp and its 20-ohm resistor for "open." This resistor is part of the 3-section voltage divider

STEWART-WARNER Chassis R-116

Weak reception at low end of dial, Set goes off calibration	1)	poor connections at soldered joints of trimmer condensers. Resolder joints and re-balance circuits
Inoperative on the broadcast band, Noise at several positions on the station selector	1)	open-circuited section in the antenna coil. Re-wind with new wire of the same size
Intermittent, or noisy operation	1)	if especially noticeable when tuning dial is turned, or tuning condenser is jarred, clean out any metal particles from between the tuning condenser plates with a pipe cleaner or air blast
Hum	1)	if filter condensers check O.K. and hum has a hollow sound, check 500,000-ohm volume control for appreciable increase in value. Replace
	2)	check for poor contact at grounding lug of the vitreous enamel voltage-divider resistor. To cure this, tighten the screw which holds down the grounding terminal, and solder it in place
	3)	cut out of the circuit the 230-ohm negative section of the bleeder resistor (the section between the grounded tap and the end going to the center-tap of the power transformer high-voltage secondary) and substitute a separate 230-ohm wire-wound resistor in its place
	4)	part of power cord within set too close to the 0.05-mfd. 100-volt isolating condenser which is connected to one side of volume control. Pull power cord away from this condenser
	5)	reverse the two speaker field coil leads underneath the chassis (where they connect to the two electrolytic condensers). The *green* lead should go to the front electrolytic condenser; the *white* one to the rear

STEWART-WARNER Chassis R-116X

Inoperative, Noisy	1)	check antenna coil for "open." Rewind the coil with original size wire
	2)	check 0.1-mfd. 400-volt by-pass condenser connected between B-plus end of 21,000-ohm oscillator plate resistor and ground, for "short" or "leakage." Replace it if necessary, and also replace the resistor with a 20,000-ohm 1-watt carbon unit
Weak, distorted reception	1)	"shorted" 0.1-mfd. condenser connected between positive terminals of electrolytic condensers. When this condenser "shorts", it shorts out the speaker field. Replace with 600-volt unit

STEWART-WARNER Chassis R-116XH

I-f trimmer requires frequent adjustment	1)	temperature causes unit to contract and expand. In regions of wide temperature variation, adjustments are required as often as every two or three months

STEWART-WARNER Chassis R-117 (used in Models 1171, 1172) Auto Radio

Intermittent slow motor-boating sound, but unable to receive radio stations	1)	locate the *red* lead that comes from the i-f transformer which connects to the plate of the '78 tube. Connect a 0.01-mfd. condenser between this *red* lead and ground
Tuning dial illuminated too brightly—interfering with driver's vision during night driving	1)	remove the 15-ohm pilot light resistor (*No. 51*). Replace it with a 35-ohm resistor (Part *No. 84197*) to reduce the dial light voltage

STEWART-WARNER Chassis R-118 (used in Models 1181, 1182, 1183) Auto Radio

Inoperative (except for faint response on powerful signals)	1)	broken lead on coupling condenser connected to movable arm of volume control
Inoperative unless "local" switch is turned on and off	1)	change 50,000-ohm resistor on '6A7 tube to a 60,000-ohm unit
	2)	if set goes into oscillation place a 0.25-mfd. condenser from cathode to ground on type '6A7 tube
Bell-like rattle	1)	loose tubular condensers inside power transformer cover. Remove cover and resolder and re-tape condensers to it

STEWART-WARNER Chassis R-120 (used in Models 1201, 1209)

Weak reception	1)	short out 2,000-ohm resistor (*R-10*) in cathode circuit of '56 oscillator tube
No short-wave reception	1)	replace '56 tube
	2)	"shorted" trimmer condenser in plate circuit of short-wave detector

(Cont'd)

STEWART-WARNER Chassis R-120 (used in Models 1201, 1209)—*(Cont'd)*

Hum	1)	insufficient filtering in power supply unit. Connect an additional 8-mfd. 450-volt electrolytic condenser from rectifier filament to center-tap lead of high-voltage secondary. Shunt additional filter condensers across the present two electrolytic units
	2)	speaker field in the high-voltage secondary return acts as the only filter choke now. Add another filter choke in series with the same line, between center-tap lead of high-voltage secondary of power transformer and speaker field
Distorted, unstable reception at resonance	1)	"open" cathode-bias section of '57 AVC tube voltage divider. Replace with 15,000-ohm 2-watt carbon resistor
Slightly distorted, Lowered output, Noisy reception	1)	open-circuited 0.02-mfd. audio coupling condenser
	2)	clean wave-band switch contacts
Steady "whine"	1)	"open" 0.02-mfd. 1,000-volt condenser *No. 83216*. Replace

STEWART-WARNER Chassis R-123, R-123A (used in Models 1231 to 1239)

Inoperative	1)	"shorted" 0.1-mfd. condenser *No. 24* connected from 6A7 screen to chassis. Replace
	2)	"shorted" 0.01-mfd. by-pass condenser connected from 41 tube plate to ground. Connect replacement unit from plate to screen grid instead
Squealing	1)	due to oscillation. Replace the 4-mfd. filter condenser that is contained in the can with the audio by-pass condenser, replace with unit of 600-unit rating

STEWART-WARNER Series R-125, R-125A, R-125X (used in Models 1251 to 1259)

Inoperative	1)	"shorted" 0.006-mfd, 600-volt tubular condenser connected between plate of 41 tube and chassis. Use a 1,000-volt replacement
Intermittent reception, Inoperative on short-wave band	1)	poor contact of wave-band switch shorting contacts
Code interference	1)	install wave-trap adjusted to 456 kc
Noise	1)	lug on 0.02-mfd, 1,000-volt metal-cased condenser (connected between line and chassis) pulled loose by line cord. Replace condenser, and adjust knot in line cord to prevent recurrence of trouble
Noise (accompanied by sudden volume changes)	1)	rotor-wipers on band switch have lost their tension and are making poor contact with contact points
Hum	1)	"open" 0.02-mfd. line filter condenser

STEWART-WARNER Chassis R-126A (used in Models 1261 to 1269)

Intermittent operation, Distortion	1)	replace 0.1-mfd. condenser *C-3* connected to grid of 75 tube
Intermittent reception or inoperation on broadcast band	1)	open-circuiting oscillator coil for broadcast band at lug to which postage stamp type condenser is connected
Noisy reception	1)	open-circuiting diode load by-pass condensers, a dual unit
Inoperative, Motorboating sound	1)	open-circuited 0.25-mfd. screen by-pass condenser
Weak short-wave reception	1)	increase oscillator plate voltage. Replace oscillator plate resistor with 15,000-ohm resistor
Slipping dial	1)	free the action of dial pointer pivot

STEWART-WARNER Chassis R-127A (used in Models 1271 to 1279)

Distortion, Whistling	1)	"open" in one section of tone control. Replace entire unit

STEWART-WARNER Chassis R-128D (used in Battery Operated Models 1281D to 1289D)

Intermittent distortion	1)	replace 500,000-ohm volume control (even if it checks apparently O.K.)
Tubes short-lived	1)	use 135 volts of "B" battery. Be sure to move the 22½-volt lead to the 16½-volt tap of the battery

STEWART-WARNER Chassis R-130 (used in Models 1301 to 1309)

Squealing on short-wave band	1)	short-wave detector shunt trimmer screw set too far out
	2)	detector circuit tuned to the receiver oscillator frequency instead of to the frequency of the desired signal

STEWART-WARNER Chassis R-136, R-137, R-138 (used in Models 1361 to 1369, 1371 to 1379, 1381 to 1389 respectively)

Poor sensitivity at low-frequency end of broadcast band, Impossible to align circuits or calibrate at 600 kc, Oscillation at low-frequency end of broadcast band	1)	large change in capacity of small fixed Bakelite condenser connected across oscillator shunt padding trimmer. Replace with an 0.000011-mfd. unit *Note*: The capacity of this unit is so small that it cannot very well be tested with an ordinary condenser tester

(Cont'd)

STEWART-WARNER Chassis R-136, R-137, R-138 (used in Models 1361 to 1369, 1371 to 1379, 1381 to 1389 respectively) —*(Cont'd)*

Insensitive above 12 mc (receiver perfectly aligned, voltages check O.K.) Shadow of station register narrows down as though signal is tuned in	1)	stray coupling within set wiring, causing spurious oscillations to be set up in the type '6A8 tube, thereby causing the control-grid to draw current, which in turn causes an AVC voltage to be produced and a consequent reduction in sensitivity. This can be eliminated by isolating the grid return of the '6A8 tube from the AVC system, by returning it directly to ground. This can be done by cutting the terminal of the coil wound with heavy wire (short-wave coil) from its lug at the other side of the grid return and soldering this wire to the grounded threaded support lug of the coil *Note*: in doing this be careful not to cut the very fine wire from another coil, which is soldered to the same terminal
Fading (intermittently)	1)	replace 110,000-ohm ¼-watt carbon resistor in the grid-return circuit of the 6A8 tube, and the two 260,000-ohm ¼-watt carbon resistors in the control-grid circuit of the 6F6 output tube

STEWART-WARNER Chassis R-142A, R-142S (used in Models 1421 to 1429)

Inoperative	1)	failure of 110-volt power switch
Code interference at 456 kc	1)	adjust the wave-trap for minimum output with the test oscillator set at 456 kc

STEWART-WARNER Chassis R-145 (used in Models 1451 to 1459)

Inoperative	1)	"open" in one of the resistors (25, 30 and 270-ohm units all connected in series) between the 6F5 plate-return and ground. Check each resistor
Distortion (excessive grid bias on 6F5 tube)	1)	the 25-ohm ½-watt wire-wound resistor section (mentioned above) changed in value. Even a change of only a few ohms may cause this trouble
Motorboating sound	1)	by-pass the 270-ohm resistor section (mentioned above) with a 10 or 15-mfd. electrolytic condenser

STEWART-WARNER Chassis R-147 (used in Models 1471 to 1479)

Hum between stations	1)	remove the 0.5-mfd. condenser connected from the chassis to the mounting nut of the input electrolytic condenser (the one nearest the power transformer). Replace the 0.5-mfd. condenser with a 10-mfd. 25-volt electrolytic condenser. The positive terminal of this condenser must be connected to the chassis. This change should always be made in combination with the following one, since either change may increase the hum if made alone Locate the 210,000-ohm resistor connected from the plate of the 6C5 tube to one of the 5Z4 socket terminals

(Cont'd)

STEWART-WARNER Chassis R-147 (used in Models 1471 to 1479)—*(Cont'd)*

Hum between stations —*(Cont'd)*

(*a*) Disconnect the end of this resistor going to the 5Z4 socket

(*b*) Connect a 51,000-ohm resistor in series with the disconnected end of the resistor and the lug on the 5Z4 socket from which it was unsoldered

(*c*) Connect a 0.25-mfd. condenser from chassis to the junction of the above two resistors

Remove the twisted *green* and *brown* wires connecting to the tone control and replace them with a shielded twisted pair. Ground the shield at *both ends.* Route the shielded wire so that the shielding does not ground the mounting nut on the electrolytic condenser nearest the power transformer

Separate the single *green* volume control wire from the transformer and a-c leads

In all cases of either residual or modulation hum, tighten down the power transformer mounting screws after the set is hot

Early production sets did not have the resistance-capacity filter consisting of a 260,000-ohm resistor and a 0.1-mfd. condenser in the grid circuit of the 6F5. In these early sets a 1.1-meg. resistor was connected from the 6F5 grid to the bias resistor network. The later sets used a 760,000-ohm resistor connected from the grid to the filter resistor and condenser. On any of the early sets which do not have the filter, a 260,000-ohm, ¼ watt resistor should be added in series with the end of the 1.1-meg. grid resistor which connects to the bias network. A 0.1-mfd, 150-volt condenser should be connected from chassis to the junction of the 260,000-ohm and 1.1-meg resistors

Modulation hum (heard on stations only)

1) replace the 0.1-mfd. screen grid by-pass condenser (*No. 28*) connected to the 6A8 socket with the 0.5-mfd, 150-volt by-pass condenser which was disconnected from the mounting nut of the input electrolytic condenser (see above)

2) *Important*: If there is still too much hum after the above changes be sure to check for defective tubes

STEWART-WARNER Chassis R-148 (used in Models 1481 to 1489)

Hum between stations

1) locate the *red-blue* wire running from the 5V4G socket heater terminal to the speaker socket. Disconnect one end of the wire and re-route the wire along the back of the chassis so that it is at least two inches above the 6H6 and 6C5 sockets when the chassis is upside down. Reconnect the wire

A twisted pair should be placed along the front of the chassis so it can be used to connect the heater terminals of the 6K7 r-f and the 6L6 sockets. First connect a *black* wire to the grounded heater terminal of the 6K7 r-f socket (the heater terminal near the front of the chassis) and a *blue* wire to the "hot" heater terminal of the same socket. The other end of the *black* wire must be connected to the grounded heater terminal of the 6L6 nearest the *front* of the chassis and the other end of the *blue* wire must be connected to the hot heater terminal of the other 6L6 socket (the one nearest the 6C5)

(Cont'd)

STEWART-WARNER Chassis R-148 (used in Models 1481 to 1489)—*(Cont'd)*

Hum between stations —*(Cont'd)*

Remove the input audio transformer mounting screw nearest the front of the set. Rotate the transformer around its other mounting screw until the free end is toward the rear of the chassis. There is a hole in the chassis at the proper point to mount the transformer by means of the small machine screw, lock-washer and nut. Pull the transformer leads away from the tube sockets. Sometimes an intermediate position of the transformer will result in less hum but this necessitates drilling either one or two new mounting holes Tighten down the power transformer mounting bolts preferably when the set is hot

Modulation hum (heard on stations only)

1) remove the 0.1-mfd, 150-volt condenser connected to the screen-grid circuit of the 6K7 r-f tube. Replace it with a 0.5-mfd. 150-volt paper condenser

STEWART-WARNER Chassis R-149 (used in Models 1491 to 1499)

5V4G tubes burn out repeatedly

1) replace the two 0.006-mfd. paper condensers connected between the plates of the 6L6 output tubes and chassis with 0.005-mfd. 1600-volt condensers

Hum between stations

1) locate the *red-blue* wire running from the 5V4G socket heater terminal to the speaker socket. Disconnect one end of the wire and re-route the wire along the back of the chassis so that it is at least two inches above the 6H6 and 6C5 sockets when the chassis is upside down. Re-connect the wire

Locate the long *blue* wire running from the power transformer to the front 6L6 socket. Cut this wire so that the part from the power transformer is about 7 inches long and connect it to the grounded heater terminal of the 6K7 r-f socket. *Remove the balance of this wire which goes to the 6L6 socket*

A twisted pair should be placed along the front of the chassis so it can be used to connect the heater terminals of the 6K7 r-f and the 6L6 sockets

Remove the input audio transformer mounting screw nearest the front of the set. Rotate the transformer around its other mounting screw so that the free end can be fastened by one of the output transformer mounting screws. Pull the transformer leads away from the tube sockets

Tighten down the power transformer mounting bolts, preferably when the set is hot

Check the set for residual hum and if there is still too much, install a filter choke and condenser as explained below

Mount and connect the filter choke (Part *No. 110058*) as follows:

(Cont'd over)

STEWART-WARNER Chassis R-149 (used in Models 1491 to 1499)—*(Cont'd)*

Hum between stations —*(Cont'd)*

(*a*) Drill two holes in the back of the chassis so that the choke can be mounted in the position shown in the diagram

(*b*) Connect the *red-blue* choke lead to the unused 5V4G socket terminal

(*c*) The long *red-blue* wire from the speaker socket should be unsoldered from the 5V4G heater terminal and connected to the unused 5V4G socket terminal to which the *red-blue* choke lead is connected

(*d*) Connect the *red* choke lead to the 5V4G heater terminal which is connected to the input electrolytic condenser by a *red-blue* wire

Mount and connect the 8-mfd. 450-volt electrolytic condenser (Part *No. 110057*) as follows:

(*a*) Drill a hole in the end of the chassis, 5¼ inches from the front and ⅝ inches from the bottom, and mount the condenser as shown, so that the *brown* lead is towards the front of the chassis

(*b*) Connect the *brown* condenser lead to the negative terminal of the input electrolytic condenser (the condenser nearest the power transformer)

(*c*) Connect the *red-white* condenser lead to the dead 5V4G socket terminal to which the *red-blue* choke and speaker socket wires were connected

2) *Important*: If too much hum still exists after making the foregoing changes, it it most likely caused by defective tubes. Although any of the tubes can cause hum, the 6L6s should be checked first by noting whether they heat up equally. This can be done by touching them after the set has been turned on a few minutes. If the temperatures are obviously unequal, try replacing both the hot and the cold tubes, first one, then the other. Unbalanced rectifier tubes can also be the reason for hum

Modulation hum (heard on stations only)

1) make these changes even though no modulation hum is heard in the shop Remove the 0.01-mfd. condenser and 111,000-ohm resistor connected to the screen grid terminal of the 6K7 i-f tube. Connect this 6K7 screen grid terminal directly to the 6J7 screen grid. Add a 0.01-mfd. 1500-volt line buffer condenser from chassis to the side of the power transformer primary not already connected to the original 0.012-mfd. line buffer condenser

Insufficient deflection of tuning eye

1) since the narrowing of the shadow in a tuning eye depends on the strength of the receiving signal, it will narrow the most for powerful nearby stations, while on distant stations it will close much less. If a set is used with no aerial or too short an aerial the eye will not close the normal amount

In all models, if the tuning eye does not close enough and if this is not caused by the above reasons, be sure to check the tubes and the alignment

(Cont'd)

STEWART-WARNER Chassis R-149 (used in Models 1491 to 1499)—*(Cont'd)*

Insufficient deflection of tuning eye —*(Cont'd)*

In the later production of the model 1495 the circuit was changed slightly to give more deflection of the eye on weaker signals. You can determine whether this change has been made without removing the chassis from the cabinet Tune in a local station and then remove the 6H6 tube located next to the 6C5 tube. If the proper tube is removed, the radio signal will get louder or distort. In the latest production sets removing this tube should cause the tuning eye shadow to narrow or disappear. If removing the above 6H6 tube causes the shadow to widen to its full width then the eye is not connected properly.

To correct the wiring remove the chassis from the cabinet and trace the wiring of the tuning eye grid wire. This is the *green* and *white* wire in the tuning eye cable and will be found connected to the blank pin terminal on the 6H6 socket located adjacent to the 6C5 tube. Disconnect the *green* and *white* tuning eye lead from this terminal. This lead should then be connected to the blank pin terminal on the 6H6 tube located nearest to the 6J7 AVC-amplifier tube

The AVC i-f and broadcast trimmers should be realigned after these changes have been completed

STEWART-WARNER Chassis R-161D and R-164D (used in Models 1611D to 1619D, and 1641D to 1649D respectively)

Inoperative (driver transformer burned out)

1) check 0.0011-mfd. mica condenser connected between 1H4G tube plate and ground for "short" or "leakage." Replace condenser and driver transformer

STEWART-WARNER Chassis R-171 (used in Models 1711 to 1719)

Pilot light burn-out causes poor reception

1) due to filament voltage drop caused by opening of pilot lamp filament circuit. Replace pilot lamp at once

STEWART-WARNER Chassis R-172A (used in Models 1721 to 1729)

Weak, or inoperative on broadcast band (short-wave reception O.K.)

1) "short" at the broadcast antenna shunt trimmer on top of center section of 3-gang tuning condenser. A soldering lug on the condenser framework is too close to the trimmer and should be bent up to clear

STEWART-WARNER Chassis R-173 (used in Models 1731 to 1739)

Inoperative

1) check for "leaky" 0.02-mfd. 400-volt paper audio coupling condenser which may be putting a *positive* voltage on the grid of the 6F6 output tube

STEWART-WARNER Chassis R-180A (used in Models 1801 to 1809)

Insensitive, Dial off calibration, Impossible to align at low end of dial	1)	add a 250-mmfd. mica condenser to the 520-mmfd. unit which is already across the oscillator padder condenser

STEWART-WARNER Chassis R-184 (used in Models 1841 to 1849)

Dial pointer and tuning condensers do not move (but motor runs) when station selector button is pressed	1)	trouble in clutch assembly. Remove and inspect U-shaped spring washer which fits between gears and collar on clutch
Motor hums but does not run	1)	reversing contacts on back switch not closing
	2)	low line voltage, or improper line frequency
Intermittent operation of motor and lights	1)	insufficient contact pressure, or dirty contacts, on back or side switch
Slight hum when station selector button is depressed (not heard when button is released)	1)	poor or defective discriminator tube
Signals are heard when tuning from one station to another automatically	1)	"muting" contact on back switch not closing, or making poor contact
Set noisy electrically when starting and stopping during automatic tuning	1)	insufficient antenna
	2)	"muting" contacts on back switch closing too late and opening too soon
Broad tuning	1)	AFC contacts on side switch not closing

STEWART-WARNER Chassis R-202A

Inoperative (no voltage on first detector and i-f tube screen grids)	1)	open-circuited 6,000-ohm screen-grid supply resistor. Replace with new unit

STEWART-WARNER Chassis R-301A, R-301B, R-301E (S. W. Converter)

Inoperative (especially on high-frequencies)	1)	plate voltage on '27 oscillator tube low. This voltage must be maintained above 100 volts. If it is below this value, remove the 17,500-ohm series resistor (in the *red* plate lead) entirely, or substitute one of lower value to supply 100 volts to the plate

(Cont'd)

STEWART-WARNER Chassis R-301A, R-301B, R-301E (S. W. Converter)—*(Cont'd)*

Inoperative (especially on high-frequencies) —*(Cont'd)*	2)	while working on the chassis, resolder all connections to the coils and other high-frequency connections, as they must be maintained at the lowest possible resistance value for best results
	3)	check for "leaky" 1-mfd. 400-volt plate by-pass condenser (connected between the 25,000-ohm 1-watt plate-supply resistor and ground. Replace with a 2-mfd. 600-volt unit
	4)	check for faulty toggle switch
Inoperative (no plate voltage)	1)	remove both tubes and clean prongs thoroughly
	2)	see that shield of '27 oscillator is not touching condenser gang
	3)	check for faulty 2-mfd. by-pass condenser located directly below gang condenser. Use dry electrolytic tubular unit for replacement
Weak reception (all tubes, circuits etc. check O.K.)	1)	resolder every connection in the converter even though they may all seem O.K.
Cross-talk from broadcast stations	1)	make certain that broadcast receiver dial is set just above 1000 kc. Make the connecting wire from the output of the converter to the broadcast receiver antenna post as short as possible
Dial slips	1)	twist a thin rubber band around each rubber pulley

STEWART-WARNER Chassis R-304 (used in Models 3041 to 3049)

Whistling or squealing or "growling" (especially when tuned to weak stations)	1)	connect an external ground to the receiver
	2)	if an external ground is not available, oscillation can be prevented by connecting a 0.01-mfd., 1000-volt buffer condenser from one side of the power line to chassis. In connecting the condenser, first solder one side to the chassis. Touch the other lead to one terminal of the line cord and note whether the hum increases. If the hum increases touch the condenser to the other line cord terminal. This will usually be the line cord terminal which connects to the off-on switch. Solder the condenser in this position permanently *Note*: Later production receivers are built with such a line buffer condenser to prevent any oscillation. Sets having the condenser can be identified by the letter "S" on back of the chassis also on the outside of the carton near the serial number

STEWART-WARNER 800 Series

Squealing (due to oscillation)	1)	shift position of antenna coil until oscillation stops. (This must be done with the outside case on the chassis plate.) The antenna coil is located under the rear left-hand corner of the set, facing its tuning control

STEWART-WARNER 801, 801A, 811, 811A

Weak reception	1)	check the 100,000-ohm detector plate resistor located under front part of bottom resistor strip

STEWART-WARNER 900 Series

Inoperative (no plate voltage on '27 tubes)	1)	turn chassis upside down and check the 7,000-ohm wire-wound resistor at the front left-hand corner. If the "open" occurs near one end of the resistor, it may be repaired
Intermittent fading	1)	faulty 0.25-mfd. 200-volt r-f cathode by-pass condenser (in can with two other by-pass units and has a *green* lead)
No control of volume	1)	check the 0.25-mfd. r-f cathode by-pass condenser (in can with two other by-pass units and has a *green* lead)
	2)	check neutralizing condensers for "shorted" condition
Hum	1)	install *similar* resistors between 75,000 and 100,000-ohms in value between the control grid of each '45 power tube and chassis

STEWART-WARNER 950 Series

Inoperative, Weak reception with excessive hum	1)	check 0.25-mfd. 200-volt condenser in detector cathode circuit
	2)	check speaker field resistor
	3)	check filter condensers
Weak reception	1)	changed value of 45,000-ohm *red* resistor connected from B plus r-f plate line to ground. Replace if it is charred or burned in appearance
	2)	if plate voltages are slightly low and screen voltage on three r-f tubes is high, check 20,000-ohm 3-watt screen grid resistor (*purple* resistor). Replace with 5-watt wire-wound unit
Squealing at low-frequencies	1)	clean and adjust tuning condenser rotor wipers
Squealing at high-frequencies	1)	"open" 0.25-mfd. r-f by-pass condenser located close to r-f coils
	2)	if oscillation is accompanied by distortion, try replacing 0.25-mfd. r-f grid by-pass condenser
Squealing when "quick-heater" tubes are used	1)	replace 0.25-mfd. screen-grid by-pass condenser with 0.5-mfd. or more
	2)	reduce the screen voltage if necessary
Buzzing, crackling and intermittent reception	1)	faulty 20,000-ohm 2-watt *purple* carbon screen grid resistor. Replace with 5-watt wire-wound unit
Volume control burns out	1)	the screen voltage, which is controlled by the volume control, is bled through the *purple* 20,000-ohm 2-watt resistor. Its resistance may gradually drop in value and cause the control to burn out. When replacing the control, check this resistor as well, and replace it if necessary with a 5-watt wire-wound unit
Volume control becomes noisy	1)	if repeated cleaning and replacement fail to effect a permanent remedy, disconnect the antenna circuit from the left-hand end of the control and connect it (the antenna circuit) to the chassis instead. This isolates the antenna circuit from the noisy control

STEWART-WARNER Models 1121, 1122, 1123 Auto Radios

See Case Histories listed under Stewart-Warner Chassis R-112

STEWART-WARNER Models 1171, 1172 Auto Radios

See Case Histories listed under Stewart-Warner Chassis R-117

STEWART-WARNER Models 1181, 1182, 1183 Auto Radios

See Case Histories listed under Stewart-Warner Chassis R-118

STEWART-WARNER Models 1201, 1209

See Case Histories listed under Stewart-Warner Chassis R-120

STEWART-WARNER Models 1231 to 1239

See Case Histories listed under Stewart-Warner Chassis R-123

STEWART-WARNER Model 1236B

See Case Histories listed under Stewart-Warner Chassis R-123

Whistling or squealing	1)	replace 4-mfd. filter condenser in can with audio by-pass unit. Use a replacement of higher voltage rating

STEWART-WARNER Models 1251 to 1259

See Case Histories listed under Stewart-Warner Series R-125, R-125A, R-125X

STEWART-WARNER Models 1261 to 1269

See Case Histories listed under Stewart-Warner Chassis R-126A

STEWART-WARNER Models 1271 to 1279

See Case Histories listed under Stewart-Warner Chassis R-127A

STEWART-WARNER Models 1281D to 1289D (Battery Receivers)

See Case Histories listed under Stewart-Warner Chassis R-128D

STEWART-WARNER Models 1301 to 1309

See Case Histories listed under Stewart-Warner Chassis R-130

STEWART-WARNER Models 1361 to 1369, 1371 to 1379 and 1381 to 1389

See Case Histories listed under Stewart-Warner Chassis R-136, R-137, R-138

STEWART-WARNER Models 1421 to 1429

See Case Histories listed under Stewart-Warner Chassis R-142A, R-142AS

STEWART-WARNER Models 1451 to 1459

See Case Histories listed under Stewart-Warner Chassis R-145

STEWART-WARNER Models 1471 to 1479

See Case Histories listed under Stewart-Warner Chassis R-147

STEWART-WARNER Models 1481 to 1489

See Case Histories listed under Stewart-Warner Chassis R-148

STEWART-WARNER Models 1491 to 1499

See Case Histories listed under Stewart-Warner Chassis R-149

STEWART-WARNER Models 1611D to 1619D and 1641D to 1649D

See Case Histories listed under Stewart-Warner Chassis R-161D anw R-164D

STEWART-WARNER Models 1711 to 1719

See Case Histories listed under Stewart-Warner Chassis R-171

STEWART-WARNER Models 1721 to 1729

See Case Histories listed under Stewart-Warner Chassis R-172A

STEWART-WARNER Models 1731 to 1739

See Case Histories listed under Stewart-Warner Chassis R-173

STEWART-WARNER Models 1801 to 1809

See Case Histories listed under Stewart-Warner Chassis R-180A

STEWART-WARNER Models 1841 to 1849

See Case Histories listed under Stewart-Warner Chassis R-184

STEWART-WARNER Models 3041 to 3049

See Case Histories listed under Stewart-Warner Chassis R-304

ST. REGIS

ST. REGIS 777, 778, 779, 781

Whistling or squealing	1)	install a shield over the 6A7 tube

STROMBERG-CARLSON

STROMBERG-CARLSON High-Fidelity and Labyrinth Speaker Models (General Servicing Notes)

High-fidelity control detunes receiver, Tuning can be sharpened appreciably, after adjusting for High Fidelity	1)	this indicates lack of attention to the Instruction Books accompanying each receiver, which specifically state that: "On the broadcast band, a High-Fidelity Stromberg-Carlson radio should *always* be tuned with the fidelity control set for Standard Fidelity. *Never* re-tune the set after advancing to the High-Fidelity position." The change in tuning meter swing or in the shadow on the Tri-Focal Eye tube, noticed when adjusting from Standard to High Fidelity, indicates a broadening of the sidebands to give a wider frequency response. If the operator retunes the radio after adjusting to high fidelity—or if he then tunes in another station without returning to standard fidelity—the receiver will invariably be tuned to one or another slightly off-resonance peak, resulting in distortion Instruct prospects and customers as to the proper method of tuning a high-fidelity radio set The standard-fidelity position on Stromberg-Carlson models employing the Big Bronze Dial is indicated by half-red and half-white showing in the Fidelity-Tone Control aperture and a small white dot appearing on the red side. At "low-fidelity" condition, the tone control is fully operative For short-wave reception, the above instructions do not apply. Turn the High-Fidelity control so that the red part of the indicator covers approximately three-quarters of the aperture. This provides maximum sensitivity on the short-wave ranges, and at the same time spreads the tuning a little for easier locating of short-wave stations

(Cont'd)

STROMBERG-CARLSON High-Fidelity and Labyrinth Speaker Models (General Servicing Notes)—*(Cont'd)*

Background "swish" in High Fidelity Models	1) 2)	insufficient antenna faulty 6A8 tube. This may not be revealed by a tube tester. Try replacing the tube
Tuning meter inoperative in All-wave Models	1)	remove left side of tuning chassis and look for a loose connection of the long silver rod connected to the waveband selector switch
"Cross-talk" on receivers using Stromberg-Carlson all-wave antenna systems	1)	high-resistance leakage across lightning arrester
Acoustic coupling in Phono-radio models	1)	install sponge rubber under all four corners of motor board—and at four sides
Distortion at low volume when playing phono records	1)	remove any iron filings present on magnet around needle armature
Imperfect operation of 6E5 "eye" tube	1) 2)	if "eye" overlaps, replace 6E5 tube if "eye" does not close, look for grounded r-f or i-f bias circuit
Crackling noises	1)	due to imperfect contacts at each terminal of Candohm voltage divider. Replace
Rattling and distortion in models employing a Labyrinth speaker	1) 2) 3) 4) 5) 6) 7) 8) 9)	remove speaker and turn receiver "on." If rattle is still heard, check for a loose voice coil. Cement in place securely. If the voice coil is O.K., check for: foreign particles in speaker damaged or defective speaker cone voice coil off center loose grille cloth if rattling stops when speaker is removed from labyrinth, check for the following: foreign particles such as screws, pieces of wire or solder, etc., on top of labyrinth, or between labyrinth and cabinet loose screen over labyrinth exhaust in bottom of cabinet. Tack it down so it will not rattle. Its purpose is to keep mice, etc., from nesting in the radio cabinet warped or loose sound-spreading vanes striking against speaker cone or leather. Straighten and tighten the vanes

STROMBERG-CARLSON (FARNSWORTH) Record Changers

The tripping apparatus of all Farnsworth changers used in Stromberg-Carlson receivers has remained basically unchanged. It combines a radial and an accelerated motion trip; that is, it will trip when the needle is at a predetermined distance from the spindle, and it will also operate on a speed-up of the tone-arm.

The adjustments are not difficult when it is understood that the two collars on the tonearm bracket act on the two types of tripping.

These two collars are mounted on the underside of the tone-arm bracket, and move with the tonearm as it advances with the groove while playing. The lower collar and the small coiled spring control the fixed distance from the spindle at which the release operates—this collar should be adjusted so that it will trip when the needle is approximately 1⅞" from the spindle.

The upper collar is part of the friction trip assembly, the other parts of which are a cork and a spring washer and a short friction trip lever. The position or adjustment of the upper collar controls the pressure which the short lever exerts against the long trip finger as the needle follows the recording. As the trip finger moves and reaches the starting lever release, it presses against this release, which is pushed back or restored once each revolution of the spindle by a small dog or cam on the spindle gear.

The upper collar should be so adjusted that the starting lever release, when the trip groove is reached, is pushed from its position where it keeps the starting lever on the cam gear from falling. The trip finger should exert a constant pressure, enough to move the release lever, but not enough to cause a loud tapping as the spindle cam strikes the spring on the trip release lever.

The spring on the end of the release lever should be set to such an angle that the restoring action of the spindle gear cam causes it to overlap the starting lever about 1/16". If the overlap is much greater than this, the starting lever will not drop easily enough and it will not operate on a trip groove having a short run-in. If the overlap is less, the starting lever will drop too easily, and the trip may operate too soon, especially with a record having a slightly off-center spindle hole. The amount of this overlap is a very important item and it should be checked with care.

The starting lever, on dropping, substitutes for the missing teeth on the cam gear, causing it to engage with the spindle gear and thus be turned through one revolution and cause a complete change cycle.

The settings of the three adjustments—the two collars and the release lever spring—are inter-related and should be changed with the thought in mind of their affect on each other. A change of one setting may mean a minor re-adjustment of another. However, the proper settings are easily arrived at and smooth, positive, action is assured if the result of changes is understood.

Preliminary checks before making any adjustments	1)	check friction lever, trip finger, and release lever to make sure they are not bent out of position, that they operate freely, and contact each other properly
	2)	check rivets which hold spring to release lever
	3)	mounting stud for release lever should be tight to panel
	4)	see that manual reject lever is not hindering automatic action
Trips near or before half played	1)	not enough overlap of starting lever release and starting lever. Bend spring release lever toward spindle
	2)	friction trip collar set too tight. Release set-screw in upper collar and adjust
Trips near end of record	1)	radial trip operates too soon. Release set-screw in lower collar, and adjust

(Cont'd)

STROMBERG-CARLSON (FARNSWORTH) Record Changers—*(Cont'd)*

Does not trip positively on short (⅛") run-in, or on records having relatively small recorded area	1)	too much overlap of starting lever release and starting lever. Bend spring on release lever away from spindle
	2)	friction trip collar set too loose. Release set-screw in upper collar and adjust

STROMBERG-CARLSON (GARRARD) Record Changer

Arm and needle scratch across record at beginning of rejection cycle	1)	inspect to see if stiff piece of spaghetti covering shielded lead is coming out of pickup arm. Untwist this wire and allow it to hang loosely

STROMBERG-CARLSON 10, 11

Inoperative	1)	one or both coupling condensers for the antenna to the first band-pass unit, and from here to the second unit, "shorted" to chassis. Remove the gang condenser shield to determine whether or not these units are "shorted"
	2)	"grounding" of insulated screws in condenser shields connected to stators of tuning condensers
Intermittent reception	1)	open-circuiting 0.04-mfd. bi-resonator condensers
Weak, Distorted reception	1)	primary of push-pull input transformer short-circuiting to secondary winding
Fading	1)	leaky 0.04-mfd. bi-resonator condensers
Fading (operative only with volume control at maximum setting)	1)	open-circuited 700-ohm section of voltage divider resistor. Replace with a 10-watt unit
Noisy reception	1)	noisy primary of push-pull input transf.
Poor control of volume	1)	breakdown of 0.015-mfd. condenser connected in series with the ground
Poor control of volume (receiver operates at full volume regardless of volume control setting)	1)	defective 100,000-ohm resistor connected between the grid returns of the first and third r-f tubes and the movable arm of the volume control potentiometer
	2)	short-circuited, or leaky, 0.3-mfd. by-pass condenser connected between the movable arm of the volume control potentiometer and the chassis
Whistling or squealing	1)	clean tuning condenser rotor wipers
	2)	apply hot soldering iron to all lugs on by-pass condensers
	3)	"open" by-pass condensers
	4)	loose tube shields
	5)	poor contacts at tuning condenser rotor bearings

STROMBERG-CARLSON 12, 14

Inoperative	1)	shorted detector plate filter condenser
	2)	open detector plate filter choke
Intermittent reception	1)	open-circuited 0.04-mfd. bi-resonator condensers

(Cont'd)

STROMBERG-CARLSON 12, 14—*(Cont'd)*

Poor tuning meter action	1)	insufficient antenna
	2)	poor second type '24-r-f tube
	3)	change AVC tube
Noisy reception, Fading	1)	leaky 0.04-mfd. bi-resonator condensers
	2)	defective volume control. Replace with new unit
Both type '80 tubes spark	1)	intermittently short-circuiting filter condenser

STROMBERG-CARLSON 19, 20

Inoperative (tubes do not light up)	1)	faulty '80 tube caused fuse to "blow"
Intermittent reception	1)	oscillator coil leads snapped at lug
	2)	open-circuiting 0.04-mfd. bi-resonator condenser
Intermittent fading, Distortion	1)	intermittently defective 0.001-mfd. condenser connected across the 10-megohm resistor in the grid circuit of the detector stage. Replace with a new unit
	2)	open-circuiting 10-megohm resistor in the detector stage grid circuit. Replace with a new unit
Intermittent hum	1)	open-circuited 3-ohm center-tapped resistor located near the first i-f tube socket, under the chassis. Replace with new unit

STROMBERG-CARLSON 22, 22A

Inoperative (no plate voltage on second i-f tube. All other plate voltages low)	1)	short-circuited 0.0001-mfd. mica coupling condenser connected between the plate of the second i-f tube and the secondary of the last i-f transformer or the 2nd detector tube cathode. This is located at the base of the transformer inside the shield, just above the phone jack
	2)	short-circuited i-f trimmer condenser. Replace with new unit
Intermittent reception, Noisy reception	1)	short-circuiting i-f trimmer condenser
	2)	poor connections to carbon resistors
Intermittent reception	1)	open-circuiting 0.04-mfd. condensers used as bi-resonator and first detector secondary return by-pass units
Poor action of tuning meter	1)	insufficient antenna. Lengthen antenna
	2)	shunt 30-ohm resistor across meter terminals
Fading, Weak reception	1)	grounding of screw passing through first tuning condenser shield and connected to stator of first tuning section

STROMBERG-CARLSON 25, 26

Inoperative	1)	examine chassis bolts. These often extend too far and touch the voltage divider
	2)	primary of push-pull input transformer "shorting" to core, or to secondary winding
Set starts, and then stops playing	1)	look for loose wire in tuning condenser compartment. This wire may still be in place, but may not be well soldered
	2)	check 100,000-ohm fixed resistor in series with center lug of volume control. This sometimes loosens and "shorts" to ground

(Cont'd)

STROMBERG-CARLSON 25, 26—*(Cont'd)*

Intermittent operation	1)	"open-circuiting" 0.04-mfd. bi-resonator condensers
	2)	shield cans cutting into connecting leads to coils
	3)	primary of push-pull input transformer "shorting" to core, or to secondary winding
Fading, Erratic operation, Receiver drifts off frequency setting of tuning dial (stations tunable at two points on the dial, about 20-kc apart), No control of volume, Double-spot reception	1)	defective 0.04-mfd. bi-resonator condensers
	2)	screw which passes through the shield of the third gang condenser section, and which is connected to the stator plates and insulated from the shield by means of wax or insulating compound, short-circuiting to shield. Disconnect the wire from the screw to the stator plates. The same trouble is also possible in the case of the similar screw passing through the shield of the first gang condenser section *Note*: to avoid further trouble of a similar nature it may be well to remove both of the above screws, as they serve no useful purpose and are a constant potential source of trouble
Distortion at any volume level	1)	leaky second detector cathode by-pass condensers
Distortion at low volume	1)	change second detector type '24A tube
Distorted, Weak reception	1)	primary of push-pull input transformer short-circuited to secondary winding
Noisy reception	1)	noisy primary winding of push-pull input transformer
	2)	leaky 0.001-mfd. detector plate by-pass condenser
	3)	leaky second detector cathode by-pass condensers
No control of volume	1)	leaky 0.05-mfd. bi-resonator condensers
	2)	leaky 0.3-mfd. r-f, first detector and i-f secondary-return by-pass condensers
	3)	100,000-ohm resistor in control-grid secondary-return circuit shorting to chassis

STROMBERG-CARLSON 27

Inoperative	1)	short-circuited 0.0001-mfd. second i-f transformer coupling condenser
Inoperative below 800 kc, Poor action of tuning meter, Weak, Station hiss, Dial settings incorrect	1)	open-circuited section of oscillator coil secondary winding; lead snapped at lug
Fading, Intermittent, Weak reception	1)	leaky 0.04-mfd. bi-resonator condensers
	2)	open-circuiting 0.04-mfd. bi-resonator condensers
Weak reception, Poor action of tuning meter, Station hiss	1)	open-circuited primary winding of preselector coil
	2)	open-circuited bi-resonator in r-f stage
Poor action of tuning meter	1)	insufficient antenna. Lengthen antenna
	2)	open-circuited 30-ohm meter shunt
Volume cannot be made low	1)	change volume control
	2)	insulation leakage in phono pick-up switch

STROMBERG-CARLSON 29

Inoperative	1)	open-circuited tuning meter
	2)	short-circuited 0.3-mfd. r-f and first detector plate by-pass condenser
	3)	defective line switch which is incorporated in tone control. In repairing this, it may be well to interchange tone control with volume control (both are of the same value) so that the latter will control the switching of receiver, in order to avoid future trouble
Very weak, distorted reception (tuning meter operates normally)	1)	first audio grid lead shorting to plate prong of socket
Weak, Distorted reception, Station hiss	1)	r-f coil leads shorting to shield can
	2)	open-circuited primary winding of pre-selector coil
	3)	open-circuited 0.04-mfd. bi-resonator condenser
Weak reception, Station hiss	1)	open-circuited pre-selector coil primary
	2)	pre-selector coil primary grounding to metal shield of antenna binding post lead
Distortion at resonance	1)	shield can grounding to second r-f, or first detector secondary-return leads
Noisy, Intermittent reception	1)	poor contact of volume control slider arm
Noisy volume control	1)	replace first type '56 audio tube
Hum at resonance	1)	cathode-heater leakage in oscillator tube
	2)	cathode-heater leakage in type '58 tubes
Hum	1)	shield the a-f grid lead running across bottom of chassis to volume control
	2)	connect an 8-mfd. condenser between "high" side of speaker field and chassis

STROMBERG-CARLSON 33

Noisy operation	1)	faulty plate circuit winding of last i-f transformer

STROMBERG-CARLSON 37

Inoperative	1)	"shorted" 0.3-mfd. 400-volt condenser by-passing 58 i-f tube plate supply. This is a unit in by-pass condenser assembly *No. 22,702*
Rasping at room volume	1)	speaker cone off center and scraping against pole piece. Recenter

STROMBERG-CARLSON 38, 38A, 39, 40, 41, ("First" Type—9 tubes)

Weak reception, Distortion	1)	change in value of 600-ohm cathode resistor in the first r-f stage. Reception is improved when this resistor is short-circuited out of the circuit entirely
Noisy reception	1)	defective volume control. Replace
	2)	gassy first audio tube. Replace
Hum at resonance, Fading	1)	cathode-heater leakage in type '56 or '58 tubes. Test by substitution, replacing defective tubes

STROMBERG-CARLSON 38, 39, 40, 41, ("Second" Type—10 tubes)

Inoperative	1)	open-circuited tuning meter
	2)	short-circuited 0.3-mfd. r-f, first detector plate by-pass condenser
Inoperative, Intermittent reception, Meter swings to left and sticks	1)	poor weld in type '56 oscillator tube
	2)	open-circuiting oscillator coil secondary
Intermittent reception, Fading	1)	unsoldered leads to terminals on oscillator tracking condenser
	2)	unsoldered lead to terminal lug of second i-f primary trimmer condenser
Weak reception, Station hiss, Background noise	1)	open-circuited pre-selector coil primary
	2)	if this condition clears up when finger is touched to r-f type 58 tube control grid, pre-selector primary is grounded to metal braid of antenna binding post lead
Weak reception, (tuning meter action normal)	1)	short-circuited demodulator plate 2-mfd. by-pass condenser (connected from chassis to the junction point of the 4,000-ohm and 10,000-ohm resistors in the demodulator plate circuit)
Distortion at resonance	1)	shield can grounding to r-f, or first detector secondary-return leads
Noisy volume control	1)	replace 56 tube in first audio stage. (Gas in this tube will cause this trouble, causing it to draw too much plate current)
	2)	if control is still noisy, try interchanging the 55 tubes

STROMBERG-CARLSON 48, 49, 50

Inoperative (tubes and voltages check O.K.)	1)	faulty 500,000-ohm ⅛-watt resistor in plate circuit of 55 second detector
Inoperative	1)	open-circuited tuning meter
	2)	short-circuited 0.3-mfd. r-f and first detector plate by-pass condenser
	3)	open-circuited 600-ohm resistors in push-pull input transformer secondary-return circuit
Intermittent reception	1)	open-circuiting 0.04-mfd. bi-resonator condensers
Meter burns out	1)	short-circuited 0.3-mfd. meter by-pass condenser
Distortion at resonance, at low volume	1)	faulty volume control. Replace with new units
Distortion at resonance, Weak reception, Station hiss	1)	open-circuited pre-selector coil primary
	2)	pre-selector coil primary grounding to metal braid of antenna binding post lead
	3)	broken lead to 2nd section of condenser gang from coil
Distortion at resonance	1)	coil shields grounding to r-f, or first detector secondary-return leads
Hum	1)	replace type '55 tube
	2)	change position of detector plate audio choke
	3)	short detector plate audio choke out of circuit
Hum at resonance	1)	cathode-heater leakage of type '56 oscillator tube
	2)	cathode-heater leakage of type '58 tube

(Cont'd.

STROMBERG-CARLSON 48, 49, 50—*(Cont'd)*

Microphonic	1)	loosen chassis mounting bolts
	2)	insert rubber cushions under chassis
	3)	change type '55 tubes
	4)	insulate type '55 control-grid cap from control-grid lead with tape
Noisy reception	1)	noisy primary winding of intermediate push-pull input transformer
Crackling noise when receiver is switched on	1)	check 2A3 output tubes for "loose" or "shorting" elements
Tuning dial slips	1)	U-washers on friction drive mechanism binding to shaft opening of the cabinet. Loosen the mounting bolts, and raise front of chassis slightly, to free the friction drive action. Now insert thin rubber strip between chassis and wooden chassis support

STROMBERG-CARLSON 51

See also Case Histories listed for Stromberg-Carlson 48, 49, 50 receivers

Record is released near turntable spindle	1)	adjust pick-up shoe
	2)	adjust pick-up tongue
	3)	pick-up head too high or too low
Record released by carrying arm lever	1)	adjust height of rails
	2)	adjust height of turntable spindle
Needle does not slip into first groove of record	1)	shift position of pick-up head
	2)	increase tension of groove springs
Needle skips past several grooves	1)	decrease tension of groove springs

STROMBERG-CARLSON 52

Hum, "Tweets," Poor selectivity	1)	cable wires in base of chassis shifted from their original position

STROMBERG-CARLSON 54

Noisy reception (noise ceases when type '27 detector tube is removed from socket)	1)	defective double voltage divider resistor, which sparks in operation. Replace with new unit
	2)	noisy 0.0005-mfd. by-pass condenser in the detector filter unit. Replace with new unit
Hum, "Tweets," Poor selectivity	1)	"cabled" wires in base of chassis shifted from their original position

STROMBERG-CARLSON 55, 56

Inoperative	1)	if tubes and receiver circuits check O.K., examine relay mounted under the power unit to see if "shorting" contact has frozen in position or is binding so as to interfere with free operation
Intermittent reception accompanied by "popping" noises	1)	intermittently "shorting" i-f trimmer condensers. Dismantle i-f transformer assembly and clear the "shorts." Mica insulation in the trimmers may have to be renewed
Distortion	1)	"leaky" filter condensers
	2)	"leakage" between sections in filter condenser block

STROMBERG-CARLSON 60 Chassis

Fuses blow	1)	short-circuited section of line by-pass condenser
	2)	high-voltage winding of power transformer partially short-circuited
Inoperative	1)	"shorted" 0.3-mfd. condenser located in in sealed unit back of condenser
Inoperative, Whistling or squealing	1)	turn screw of second i-f transformer trimmer slightly
No short-wave reception	1)	open-circuited section of oscillator coil. Lead snapped at lug
	2)	poor switch contacts
Intermittent reception, Inoperative	1)	defective type '6A7 tube—may test O.K.
Intermittent, Noisy reception	1)	tone control defective
	2)	loose voice coil lead
Weak, needs alignment	1)	(i-f 370 kc) align i-f stages first. Then connect oscillator to antenna post and align "B" Band. Proceed with "oscillator" stage, then r-f, then antenna at 15 megacycles, low-frequency padder at 5 megacycles. Now align "A" Band (same procedure) at 1400 kc and 600 kc
Fading, Whistling or squealing, Distortion	1)	poor electrical grounding of type '6B7 tube shield
Stations received at two points 20 kc apart	1)	leaky 0.04-mfd. by-pass condensers for r-f and first detector secondary returns
Noisy reception, Crackling	1)	push-pull input transformer primary noisy
	2)	"leaky" 0.2-mfd. tone control condenser located in common by-pass block mounted directly behind tuning condenser gang
Hum	1)	poor "grounding" of 3-section electrolytic filter condenser unit to chassis. Scrape chassis and tighten mounting nut firmly

STROMBERG-CARLSON 60PR

See also Case Histories listed for Stromberg-Carlson 60 Chassis

Erratic operation of tone arm	1)	counterbalance on tone arm binding against back of cabinet. Move balance forward so it clears

STROMBERG-CARLSON 64

Fuses blow, Type '5Z3 tube blows, Power transformer smells and heats up	1)	breakdown of 1.3-mfd. input filter condenser (identified by 2 *green* leads emerging from the block). Replace with a good quality 2-mfd. 600-volt *paper* condenser
Intermittent reception, Inoperative	1)	open-circuited first audio transformer primary
Intermittent reception, Fading	1)	open-circuiting bi-resonator condenser

(Cont'd over)

STROMBERG-CARLSON 64—*(Cont'd)*

Whistling or squealing at low-frequencies	1)	increase value of bi-resonator condenser
Whistling or squealing, Motorboating sound, Intermittent reception	1) 2)	open-circuiting 0.01-mfd. r-f and first detector secondary return by-pass condensers increase value of above condensers
Hum	1)	replace filter block or dried-up section
Hum, Distortion	1) 2) 3)	leakage between sections of electrolytic filter condenser block leakage between contacts of filter condenser block socket loss in capacity of some of sections of filter condenser block
Noisy reception	1)	noisy primary of first audio transformer

STROMBERG-CARLSON 68

Fuses blow, Rectifier blows, Power transformer smells and heats up	1)	leaky or short-circuited 1.3-mfd. first filter condenser contained within second audio transformer
Tubes in tuner do not light	1)	check each tube for open heater (heaters wired in series)
No reception below 930 kc, 1300-kc station received at 940 kc	1)	oscillator section of tuning gang short-circuited. Clear bonding pigtail from stator lead
150-kc station received at 1,140 kc	1)	oscillator section of tuning gang short-circuited. Clear bonding pigtail from stator lead
Stations around 700 kc heard at three points	1)	change entire receiver for new 68-F chassis which employs an i-f of 465 kc
Intermittent reception, Inoperative	1)	open-circuited first audio transformer primary
Intermittent reception, Noisy reception	1) 2) 3)	short-circuiting i-f trimmer condensers intermediate audio transformer primary noisy push-pull input transformer primary noisy
Weak reception, Low screen voltage on r-f and first detector tubes	1)	leaky 4-mfd. electrolytic by-pass condenser for screen circuits in tuner
Shorted d-c output	1)	coupling lead between tuner and amplifier shorting to shield within cable
No control of volume, Distortion at resonance, No meter action, Meter needle off scale	1)	leakage or short-circuit between primary and secondary windings of AVC i-f transformer
Distortion at resonance	1) 2)	control-grid return-leads (bus-bar) of type '6D6 or '6A7 tube grounding to chassis leaky 0.1-mfd. by-pass condensers in type '6D6 or '6A7 secondary return circuit

(Cont'd)

STROMBERG-CARLSON 68—*(Cont'd)*

Noisy tone control, Receiver inoperative at one end of tone control	1)	leaky or short-circuited tone-control condenser—0.2-mfd. (this condenser is in the power unit)
Distortion, Hum	1) 2)	leakage between sections of electrolytic filter condenser block leakage between contacts of filter condenser block socket
Loud hum, Inoperative	1)	output transformer primary shorting to core of unit
Loud hum, Tone control noisy	1)	line-switch contact shoe shorting to tone-control lug within unit
Noisy tuner	1)	loose connection within i-f transformer
"Popping" and "crackling" noise	1) 2) 3) 4)	leakage in audio transformer between first layer of wire and core. Replace with new unit (Part *No. 24025*) short-circuiting i-f trimmers loose connections in tuner corroded fuse clips
Sparking sounds inside chassis (set plays normally otherwise)	1)	check condenser *No. 65* connected as an input filter condenser, and located in small container in the right center of chassis. Intermittent breakdown is the usual trouble. Replace with an oil type condenser if possible
5Z5 tube burns out frequently	1)	replace foregoing first filter condenser with an oil type condenser
Alignment data	1)	in aligning this Model, the AVC amplifier trimmer condenser (*C-57*) should be tuned for *minimum* between the two peaks on the output meter. With the selector unit on its right side, the top row of trimmers are for the "A" band; the second row for the "B" band; the third row for the "D" band and the fourth row for the "C" band. The "A" band low-frequency padder is on the front-left side, the lower condenser. The "B" band low-frequency padder is the left upper; the "C" band padder is on the lower right side—the "D" band has no padder. A tuning wand is practically the only way to check the bottom trimmers since even an all-fibre rod will detune them slightly

STROMBERG-CARLSON 70, 70B, 72, 72B, 72D, 74, 74B, 74D

Excessive hum	1)	defective type '2A3 tubes. Substitute several different types until the hum is found to be least objectionable

STROMBERG-CARLSON 82, 82B, 84

Distortion after playing O.K. for a while	1)	"leaky" audio by-pass condenser connected between ground and the junction of the 6D6 or 6K7 first audio amplifier screen and the voltage-dropping resistor leading from the high-voltage. Replace with 0.5-mfd. 750-volt paper condenser
Audio howl on strong signals	1)	due to vibration of oscillator coil assembly. Place several tight-fitting soft rubber washers on discs inside the coil form

STROMBERG-CARLSON 125 (AC-DC)

"On-off" switch troublesome
1) early-production receivers have a small spring in the "on-off" switch. This sometimes arcs over, permanently closing the circuit. Replace with improved type switch

Replacing dial lamps
1) facing the rear of the chassis, remove the 6K7, 6A8, 43 and 25Z5 tubes. With the right hand passed to the right of the nearest i-f transformer, remove the nearest pilot lamp from the bracket. Pull the lamp to the right side of the i-f transformer where the bulb can be removed
Insert left hand to the left of the other i-f transformer and lift clamp socket from bracket. The bulb can now be removed from the socket by supporting socket with right hand inserted over gang condenser. To remove bulb from socket, *do not* place thumb or finger directly under the bulb. Support ends of black insulator wings between the first and second fingers of the right hand. Push in on the bulb and turn slightly to left and release pressure—grasp bulb and pull out
After replacing the pilot lamps by methods similar, but opposite to the above, the tubes should be replaced in their respective sockets

STROMBERG-CARLSON 126, 127

Tri-focal eye closes or overlaps
1) almost without exception, this is due to variations in characteristics of the 6E5 tube, and is corrected by selection of a suitable tube
First make sure that the 6E5 tube is not "soft" or "gassy," causing a blue glow in the lens of the tube, which can be seen by looking across the tube in a dim light
Some "hard" tubes are also unsuitable. Any tube drawing in excess of 5-ma plate current *in the receiver circuit* (as measured by a set analyzer, not a tube analyzer) should not be used. The percentage of such tubes is rapidly being reduced by the tube manufacturers
Occasionally the 6E5 tube may be suitable and the difficulty caused by excessive plate current in the 6K7 tube used in the i-f stage

Tri-focal eye does not close enough
1) if the shadow on the target of the 6E5 tube does not reduce on nearby signals, check the aerial and ground connections for open lead-in, insufficient pickup, high-resistance joints, etc.
2) check sensitivity control knob on rear of chassis (models 130 and 140). Clockwise rotation increases sensitivity
3) check for a faulty tube in the r-f system, causing low AVC voltage
4) check for a grounded cathode bias resistor at 6K7 r-f, or 6K7 i-f socket

Dial drive (tuning knob) slips
1) where a tuning knob rotates without positive drive to the dial, check gang condenser against obstructions hindering movement or loosen drive assembly screws and shift drive assembly toward dial discs as far as screw holes will permit. Check dial discs for rubbing or binding against dial pan, or replace dial drive if none of above are effective
Improvements have been made in dial drive assemblies in later models to increase their grip on the dial

(Cont'd)

STROMBERG-CARLSON 126, 127—*(Cont'd)*

Vernier tuning knob binds or sticks
1) this usually indicates that vernier knob has been pushed too far on to shaft or that large tuning knob is not far enough on shaft, causing knobs to rub together

Vernier tuning shaft ineffective or missing
1) this indicates breakage at welded joint where ball-bearing is welded to end of shaft. New highly-tempered ball bearings have permitted stronger weld in recent drive assemblies

Replacing dial glass
1) dial glasses in early production receivers have cardboard rings cemented to glass for cushioning against the dial pan. Later production used metal shims on bed-plates for point support under clamps. Shims are provided with replacement dial glasses and should be used as instructed
Remove chassis from cabinet and place on back, with dial up. Loosen four screws allowing clamps to fall away from glass. (Model 140, only) Remove two screws holding center bar. Replace with new glass and center

Centering dial glass, Tuning dial off calibration
1) in some cases, dial glass may slip in transit, throwing receiver off calibration. If calibration is inaccurate at one end only, of broadcast scale, check for electrical alignment of oscillator rather than dial-glass slippage
High-frequency discrepancy is caused by shift of oscillator padding condenser and low-frequency discrepancy is caused by shift of oscillator series condenser. If the entire dial scale is off calibration, loosen clamps (and center bar, Model 140). Then line up vertical and horizontal centers of glass scale with center marks on the metal dial pin. Dial scale is marked at edge of the glass, but a better alignment can be had by placing a straight-edge along the vertical scale, lining up the arrows on this scale with the center marks on the dial pan
Replace all clamps (and center bar). Tighten all screws. Check calibration by tuning in several different stations

STROMBERG-CARLSON 130

See also Case Histories listed for Stromberg-Carlson 126, 127 receivers

Inoperative, Weak signals
1) faulty volume control. Disconnect entirely from circuit and put 100 volts d-c across entire resistance element. This will usually clear up the trouble; otherwise replace the control

"On-off" switch troublesome
1) early-production receivers have a small spring in the "on-off" switch. This sometimes arcs over, permanently closing the circuit. Replace with improved type switch

Weak reception, "Tweets"
1) the sensitivity control is on the back of the chassis. Its purpose is to limit the sensitivity on powerful nearby broadcast stations, preventing overloading and rectification in the r-f tube. For increased sensitivity, turn this knob *clockwise*

Replacing dial lamps
1) turn the tuning dial to about 0.9 on the broadcast band. The lamp for illumination of the pointer will be found just above the gang condenser. The other lamp is found on a fixed bracket above the gang condenser

STROMBERG-CARLSON 130H

Inoperative	1)	faulty "on-off" switch
Inoperative, Weak reception (oscillator does not function, no grid current in 6A8 tube)	1)	"open" coil, or broken lead at oscillator grid coil

STROMBERG-CARLSON 140 Chassis

See also Case Histories listed for Stromberg-Carlson 126, 127 receivers

"On-off" switch defective	1)	"on-off" switch defective (early models). Replace with improved switch unit
Inoperative, Weak reception	1)	defective volume control. Application of 100 volts d-c across volume control (with all volume control leads disconnected), usually clears up trouble
Noisy reception	1)	clean sensitivity control at rear of chassis
Weak reception, "Tweets"	1)	see Case History listed for this same trouble symptom under Stromberg-Carlson 130 receiver
Replacing dial lamps	1)	turn the dial pointer to about 1.1 on the broadcast band. The lamp for the illumination of the pointer will be found between the gang condenser and the nearest i-f transformer. The other two lamps are on fixed brackets just above the gang condenser

STROMBERG-CARLSON 140L

See also Case Histories listed for Stromberg-Carlson 140 chassis

Improving reproduction on radio, and phono records	1)	when playing records in which bass notes predominate, vibrations may be set up in the vicinity of the speaker. To prevent this, remove the wooden back from the cabinet and unscrew the 10 wood-screws holding the labyrinth to the front of the cabinet. There are six unused holes in the flange of the speaker. Fasten this securely to the baffle board with wood-screws. The metal screen fastened to the bottom of the cabinet with staples should also be securely fastened with wood-screws and large fibre washers The front and back of the labyrinth should be fastened tightly against the sides (of the labyrinth). The seams should be sealed with gummed tape. To prevent the wood back panel from vibrating, a large piece of felt or flannel can be glued to its inner side

STROMBERG-CARLSON 140P

See also Case Histories listed for Stromberg-Carlson 140 chassis

Distortion, Hum (on phono)	1)	make sure that phonograph motorboard floats entirely clear of cabinet. Be sure all 4 mounting screws are loosened, and, in excessive cases, remove the motorboard and cushion it on "live" rubber (sponge rubber is best) at center of all 4 sides. This further "damps" the motorboard against vibration If distortion persists, check for: (*a*) dull or defective phonograph needle (*b*) old-style records which are not electrical recordings (*c*) iron particles on pickup, near needle (*d*) damaged pickup head (*e*) proper mounting of counter-weight (*f*) tone control fully operated, limiting volume
Installing crystal phono pickup unit	1)	a crystal pickup unit may be substituted for the original magnetic unit for better reproduction. This is Stromberg-Carlson Package *No. 29504*. This package assembly contains the base, arm, crystal pick-up ,and three-prong plug, together with complete instructions for the change

(Cont'd)

STROMBERG-CARLSON 140P—*(Cont'd)*

Distortion, Hum (on phono) —*(Cont'd)*		*(Cont'd)*

STROMBERG-CARLSON 145 Chassis

Removing chassis from cabinet	1)	be sure to remove the two screws in the corners of cabinet before trying to remove the chassis, or the glass dial will break
Weak operation, Inoperative	1)	open-circuiting r-f, oscillator, or antenna coil. Coil leads breaking (usually at terminals). Remove coils and repair
Distortion at medium or high volume	1)	"leaky" or "shorted" 0.01-mfd. condenser connected in series with 10,000-ohm resistor connected from plate-to-plate of push-pull 6L6 tubes
Background hiss	1)	insufficient antenna. Use an antenna 100 to 300 feet long
	2)	check antenna, and antenna coil primary, for open circuit
	3)	defective 6A8 oscillator tube. (Trouble does not show in tube tester.) Replace
Setting of fidelity-tone control	1)	normal setting of the fidelity-tone control is *at the middle* — half *red*, half white. All *red* (High Fidelity) broadens the tuning and should not be used for distance reception. All *white* (Low Fidelity or Tone Control fully operated) causes muffled tone and reduced volume. A definite "bump" when passing through Normal shows that the selectivity is maximum and Tone Control is set for Standard Fidelity

STROMBERG-CARLSON 145L

See also Case Histories listed for Stromberg-Carlson 145 chassis

Weak reception, Distortion, Broad tuning	1)	"short" between primary and secondary windings (through fishpaper insulation) of r-f transformer which couples the 6K7 plate and mixer
Fading reception, and dimming of pilot lights after receiver plays a few hours	1)	heater or filament wiring "shorts" to chassis. Install new filament wiring in receiver, using wire having high-grade insulation
High voltage on grid cap of 6A8 tube	1)	"short" between the coil winding which connects to the 6A8 grid and a single-turn winding which is placed over the grid winding and insulated from it by a layer of paper. Replace the paper
Improving reproduction on radio, and phono records	1)	see Case History for this same topic under Stromberg-Carlson 140L receiver

STROMBERG-CARLSON 145P, 145SP

See also Case Histories listed for Stromberg-Carlson 145 chassis

Installing crystal phono pickup unit	1)	a crystal pickup unit may be substituted for the original magnetic unit for better reproduction. This is Stromberg-Carlson Package *No. 29006*. This package assembly contains the base, arm, crystal pickup, and three-prong plug, together with complete instructions for the change

STROMBERG-CARLSON 150 Chassis

Weak reception, Inoperative	1)	open-circuiting r-f, oscillator, or antenna coil. Coil leads breaking (usually at terminals) Remove coils and repair
Weak reception, Distortion	1)	replace 4-mfd. 350-volt electrolytic condenser connected in screen circuit of 6K7 audio tube. Use a replacement condenser having extremely low leakage
Background hiss	1)	insufficient antenna. Use an antenna 100 to 300 feet long
	2)	check antenna, and antenna coil primary for "open" circuit
	3)	defective 6A8 oscillator tube. (Trouble does not show up in tube tester.) Replace
Noisy volume control action, Low power output or "overloading," Excessive bass compensation at low volumes	1)	caused by variations in the characteristics of the 6K7 tube, causing some tubes to draw excessive grid current To prevent these troubles, circuit changes have been incorporated in all of these receivers manufactured on or after October 9th, 1936, and the same changes should be made in sets in the field where noisy volume-control action is observed. Two changes are made: (*a*) replace the 1,000-ohm bias resistor with one of 2,700 ohms for increased bias (*b*) connect a 10,000-ohm resistor across the bass compensating capacitor for smoother bass at low volumes. This connection is made from the volume control to a terminal nearby
Setting of fidelity-tone control	1)	see information listed for this topic under Stromberg-Carlson 145 receiver

STROMBERG-CARLSON 150L

See also Case Histories listed for Stromberg-Carlson 150 chassis

Increasing bass response	1)	if more bass response is desired on this model, the following changes may be made in the bass-control circuit: Remove the 10,000-ohm resistor (shown on the wiring diagram as item *No. 189*) from the low side of the volume control and replace it with 47,000-ohm resistor Part *No. 26353*. Also remove the 0.04-mfd. capacitor (shown on the wiring diagram as item *No. 110*) from the bass compensator in the volume control circuit and replace it with an 0.01-mfd. capacitor Part *No. 25149*

STROMBERG-CARLSON 155

Weak reception, Distortion	1)	replace 4-mfd. 350-volt electrolytic condenser connected in screen circuit of 6K7 audio tube. Use a replacement condenser having extremely low leakage

STROMBERG-CARLSON 160 Chassis

Removing chassis from cabinet	1)	be sure to remove the two screws in the corners of cabinet before trying to remove the chassis, or the glass dial will break
Weak reception, Distortion	1)	replace 4-mfd. 350-volt electrolytic condenser connected in screen circuit of 6K7 audio tube. Use a replacement condenser having extremely low leakage
Distortion	1)	replace weak 6J7 tube in automatic tone-control circuit
	2)	insufficient antenna
	3)	install fixed bias on 6J7 automatic tone circuit tube
Background hiss	1)	insufficient antenna. Use an antenna 100 to 300 feet long
	2)	check antenna, and antenna coil primary for "open" circuit
	3)	defective 6A8 oscillator tube. (Trouble does not show up in tube tester.) Replace with a 6J7 tube (no other changes are necessary)
Noisy volume control action, Low power output, or "overloading," Excessive bass compensation at low volumes	1)	see Case History for these same trouble symptoms listed under Stromberg-Carlson 150 receiver
Setting of fidelity-tone control circuit	1)	see information listed for this topic under Stromberg-Carlson 145 receiver

STROMBERG-CARLSON 160L

See also Case Histories listed for Stromberg-Carlson 160 chassis

Background "hiss," "Rushing" noise	1)	replace the 6A8 modulator tube Just because a 6A8 tube does not function properly in a 160 chassis does not mean that the tube is useless, as it will frequently give full satisfaction in another receiver. The trouble is thought to be due to a defective weld in the second grid of a small percentage of these tubes; this does not show up on a tube checker nor when a potential is impressed on this grid
Distortion in automatic tone control circuit	1)	variations in new 6J7 tubes occasionally cause distortion in the automatic tone control circuit of the 160-L receiver, as first released. These tubes function correctly after aging a few hours. Also it has been found possible to eliminate this possibility of distortion with new or aged tubes by adding a wire (from the *No. 4* terminal of the 6J7 socket to the ungrounded terminal of the 12-mfd. 35-volt condenser (*P-26772*) connected across one end section of the voltage divider) This modification has already been put in effect at the factory in all 160-L receivers produced after October 23, 1936

STROMBERG-CARLSON 160P

See also Case Histories listed for Stromberg-Carlson 160 chassis

Background "hiss," "Rushing" noise	1)	see Case History for this trouble symptom listed under Stromberg-Carlson 160L receiver
Installing a crystal phono-pickup unit	1)	see information listed for this topic under Stromberg-Carlson 145P receiver

STROMBERG-CARLSON 180

Removing chassis from cabinet	1)	be sure to remove the two screws in the corners of cabinet before trying to remove the chassis, or the glass dial will break
Weak reception,	1)	replace 4-mfd. 350-volt electrolytic condenser connected in screen circuit of 6K7 audio tube. Use a replacement condenser having extremely low leakage
Background hiss	1)	insufficient antenna. Use an antenna 100 to 300 feet long
	2)	check antenna and antenna coil primary for "open" circuit
	3)	defective 6A8 oscillator tube. (Trouble does not show up in tube tester.) Replace with a 6J7 tube (no other changes are necessary)
Setting of fidelity-tone control	1)	see information listed for this topic under Stromberg-Carlson 145 receiver

STROMBERG-CARLSON 231

Intermittent hum	1)	poor "grounding" contact between filter condenser case and chassis. Tighten screw holding condenser to chassis
Dial slips	1)	if belt is not loose, oil the two guide pulleys

STROMBERG-CARLSON 235

Weak reception, Distortion	1)	10,000-ohm resistor from screen to cathode of 6B8 tube dropped in value. Replace with 1-watt unit

STROMBERG-CARLSON 240M

Background "hiss," "rushing, "frying" noises	1)	insufficient antenna. Use an antenna 100 to 300 feet long
	2)	check antenna, and antenna coil primary for "open" circuit
	3)	check 0.04-mfd. grid filter condensers in the r-f and i-f secondary return circuits for "open" condition

STROMBERG-CARLSON 260L

Inoperative (intermittently)	1)	"grounded" plate winding in second i-f transformer *No. P27915.* Replace

STROMBERG-CARLSON 335

Inoperative, Volume drops (intermittently)	1)	replace dual 0.0001-mfd. mica condenser *No. 35* and *No. 36* by-passing avc line

STROMBERG-CARLSON 345

Increasing bass response	1)	make the following changes:
		(*a*) remove 4,700-ohm resistor (*R-17*) from volume control tap, and replace with a 10,000-ohm resistor (*Pc. 26343*)
		(*b*) remove the 0.15-mfd. condenser (C-*37*) from the volume control tap and replace it with a 0.1-mfd. condenser (*Pc. 24402*)
		(*c*) remove 0.001-mfd. condenser (*C-42*) from the "high" side of the volume control, and replace it with a 0.04-mfd. condenser (*Pc. 24405*)
		(*d*) *Caution*: do not mistake condenser C-38 for one of the condensers to be changed

STROMBERG-CARLSON 410-H

Scratchy sounds while tuning	1)	clean and lubricate tuning condenser rotor contacts, ground them with pigtails if necessary
	2)	lubricate dial pointer runner
	3)	if noise is caused by bronze cable, replace it with a fabric type if necessary

STROMBERG-CARLSON 420

Inoperative (only loud "hissing" sound is heard)	1)	check 6A8 filament voltage. If it is below normal, replace power transformer

STROMBERG-CARLSON 430 PL

Whistling or squealing	1)	"open" cathode by-pass condensers
Rattling sound, (especially at high volume)	1)	remove speaker labyrinth and securely fasten wire screen that covers opening in cabinet bottom

STROMBERG-CARLSON 505, 515

Inoperative, Weak reception (on F. M. band)	1)	in receivers manufactured prior to Oct. 1, 1940, check for overheating and change in value of 22,000-ohm resistor *R-8* connected between ground and second i-f transf. In most cases, this condition can be rectified by simply removing the resistor from the circuit. If regeneration or oscillation occurs after this resistor has been removed, connect a 22,000-ohm resistor between ground and the secondary of the second i-f transf. terminals *No. 4* and *No. 5*

STROMBERG-CARLSON 520PG, 520PN, 520PS

To eliminate some of reproduction of high-freq. when playing phono records	1)	in receivers manufactured previous to Nov. 12, 1940, connect a 75-mmfd. condenser (*P.-29359*) across 1.5-megohm resistor *R-6* (from Terminal No. 3 of the 6V6 output tube socket to the single point terminal block located on the mounting support bracket of the variable condenser). Effect of this condenser is to increase amount of inverse feedback voltage at the higher audio frequencies, thus reducing the high-frequency response

STROMBERG-CARLSON 535 Freq. Modulation Receiver

Inoperative on F. M.	1)	"open" 6,500-ohm resistor in screen circuit of 6AB7/1853 first i-f
	2)	"shorted" 0.01-mfd. condenser connected to one end of this resistor

STROMBERG CARLSON 535 (Freq. Mod.), 535 (Amp. Mod.)

Jamming of record changer	1)	pressure adjustment on "raising lever" too high
	2)	pin on "rest shaft" falls below main gear assembly. Adjust cut-off switch to allow as little drop of "rest lever" as possible

(Cont'd)

STROMBERG-CARLSON 535 (Freq. Mod.), 535 (Amp. Mod.)—*(Cont'd)*

Changer does not "trip"	1)	"trip lever" bent too much, so that clutch does not engage
Changer trips continually	1)	clutch not being released by "trip lever." Inspect and adjust
Changer trips erratically	1)	incorrect spacing between "trip lever" and trip arm. Should be a few thousandths of an inch
Tone arm lands erratically	1)	loose set-screw connecting vertical shaft to tone arm
	2)	"stop" spring adjustment too low or too high
Tone arm slides across first few grooves after landing on record	1)	clutch release is retarded. Turn knurled nut below "stop" spring, clockwise

STROMBERG-CARLSON 585-M

Inoperative	1)	check for "open" 150-ohm 5-watt resistor connected from rectifier cathode to first filter section. If this resistor is "open" also check for "shorting" or "leakage" between elements of rectifier tubes or power tubes as a cause of the resistor damage

STROMBERG-CARLSON 635, 636

House fuse blows	1)	short-circuited 0.01-mfd. buffer condensers
Noisy or distorted reception, No reception	1)	"open" 2,500-ohm section in voltage divider
	2)	"open" primary in first audio transformer
Noisy reception, Fading	1)	inoperative first or second audio transformer
Noisy tuning	1)	corroded condenser-gang rotor contacts
Choked reception, Distortion	1)	pilot light socket shorting to chassis
	2)	short-circuited speaker—output condenser
Whistling or squealing	1)	inoperative volume control. Replace with new unit

STROMBERG-CARLSON 641

See also Case Histories listed for Stromberg-Carlson 651 receiver

Intermittent reception, Fading	1)	loose lugs on 800-ohm volume control
Fading	1)	try replacing *front* volume control unit
Distortion (no bias voltage on '45 output tube)	1)	substitute another '45 tube for the one in the set
	2)	check filament circuit of '45 tube for "ground" at choke terminals inside the can, "ground" at midtap of centertapped resistor, etc.
	3)	check bias resistor of 3rd r-f tube for "grounding"
Noisy volume control	1)	replace *rear* unit
Continuous noise like static (even if antenna and ground wires are disconnected from receiver)	1)	faulty primary of a-f transformer following '27 detector. Replace transformer, or change to resistance coupling using 25,000 or 50,000-ohm plate resistor and 0.01-mfd. blocking condenser
	2)	overheated voltage-divider resistors. Replace

STROMBERG-CARLSON 642

See also Case Histories listed for Stromberg-Carlson 651 receiver

Intermittent reception, Fading	1)	"shorting" of detector plate choke to chassis by means of the metal container in which it is placed. Replace entire unit, or remove it, making sure the plate circuit is made continuous
Fading (signal returns at high volume when an electric light is turned on)	1)	replace 0.0005-mfd. condenser in audio-coupling unit between detector and first audio tube. This unit is located near the front volume control and contains a 10 mh. r-f choke and two 0.0005-mfd. condensers. The choke should be checked, as it may not require replacement
Fading	1)	try replacing *front* volume control unit
	2)	faulty 400-ohm *"yellow"* third r-f tube cathode resistor
Noisy volume control	1)	replace *rear* unit
Continuous noise like static (even if antenna and ground wires are disconnected from receiver)	1)	faulty primary of a-f transformer following '27 detector. Replace transformer, or change to resistance coupling using 25,000 or 50,000-ohm plate resistor and 0.01-mfd. blocking condenser
	2)	overheated voltage-divider resistors. Replace

STROMBERG-CARLSON 651

No reception	1)	shorted 0.4-mfd. by-pass condenser; shorted 2-mfd. condenser in same block with audio transformer
Intermittent reception, Fading, Noisy	1)	worn carbon element in antenna circuit volume control (located in *rear* of receiver). Replace with wire-wound unit
	2)	"leaky" 0.0005-mfd. detector plate by-pass condensers located within housing of det. plate choke (this cause will be indicated by fact that noise persists even after detector tube is withdrawn)
	3)	open-circuiting detector plate choke
	4)	intermittent short-circuiting of condensers in detector plate choke unit to can
Noisy reception, Arcing	1)	arcing of voltage divider sections
Noisy tuning, Whistling or squealing	1)	corroded condenser-gang rotor contacts

STROMBERG-CARLSON 652

Same Case Histories as listed for Stromberg-Carlson 641 and 651 receivers

STROMBERG-CARLSON 654

See also Case Histories listed for Stromberg-Carlson 651 receiver

Fading	1)	"leaky" 0.3-mfd. cathode by-pass section in the first r-f stage
Record "wow"	1)	change "felt" washers on the spindle to "rubber" washers
	2)	clean motor commutator and re-seat brushes

STROMBERG-CARLSON 734

No reception	1)	"open" 5,000-ohm plate series resistor
	2)	poor contact in phono-radio switch
Weak reception	1)	needle does not reach red line on meter. Defective tungar tubes

STROMBERG-CARLSON 841

Whistling or squealing	1)	see Case History for this same trouble symptom listed under Stromberg-Carlson 846 receiver

STROMBERG-CARLSON 846

See also Case Histories listed for Stromberg-Carlson 848 receiver

Inoperative until one of output tubes is removed	1)	shorted primary-secondary push-pull input transformer
Weak reception	1)	"open" antenna coil. If winding does not check "open," resolder all joints at coil lugs. Check 20,000-ohm sensitivity control for change in value. Replace. Realign r-f stages at 1,400 kc
Whistling or squealing Noisy tuning, Motorboating sound between stations	1)	dirty or high-resistance tuning condenser rotor contacts. Clean contacts or solder flexible pigtails between rotors and condenser frame
Noisy reception, Static (antenna and ground wires disconnected from receiver)	1)	short-circuited turns on high-resistance joints in the first a-f transformer following the type '27 detector tube. Replace with new unit
Little or no swing of tuning indicator pointer even on strong signals	1)	check AVC tube, and replace if necessary
	2)	check second and third r-f screen-grid tubes
	3)	"open" or "grounded" 100,000-ohm resistor
	4)	"open" or "shorted" by-pass condensers in cathode, grid, or plate circuits of AVC tube
	5)	"shorted" by-pass condenser in first or second r-f stage
	6)	"shorted" 0.5-mfd. by-pass condenser in detector circuit
	7)	if tuning meter does not operate at all, check the 390-ohm biasing resistor for an "open"

STROMBERG-CARLSON 846A

Weak reception	1)	"open" antenna coil. Replace coil
	2)	20,000-ohm sensitivity control changed value. Replace
Whistling, Motorboating sound	1)	clean all wiper contacts on tuning condenser rotor. Install pigtails
	2)	faulty 10-ohm center-tapping variable rheostat across filament winding of detector tube. The ends of the wire on the rheostat may be soldered to the lugs for permanent contact

STROMBERG-CARLSON 848

Intermittent fading, Antenna control inoperative	1)	check small wire-wound resistor in series with antenna control, which is in turn shunted across the antenna coil. Disconnect resistor and tighten up rivet, holding one end

STROMBERG-CARLSON 925 and 1025 Series Receivers

Insufficient sensitivity on FM in districts remotely located from FM transmitters	1)	shunt a 4,700-ohm resistor across the 47,000-ohm section of the "B" voltage divider. This reduces screen voltage on first limiter by approximately 1 to 14 volts and improves sensitivity
	2)	use a good antenna

STUDEBAKER

STUDEBAKER-(Philco) S-1726

Inoperative, Intermittent reception	1)	inspect chassis for melted wax from tone control condensers into 7C5 output tube socket. Clean out or replace socket. Replace condensers. Provide better ventilation by drilling holes in bottom plate over region of socket

SUN-GLOW

SUN-GLOW "Melody Chest"

Inoperative	1)	defective 0.5-mfd. section of 4-unit metal-clad by-pass condenser pack, which connects to B-plus. Replace with new single-section unit externally connected

TCA

(For additional Case Histories of TCA (Transformer Corp. of America) receivers, see listing under CLARION)

TCA Chassis

(Used in following receivers: Brunswick 10, Bulova M501, Clarion 40, Columbia SC31, Temple 10)

Scratchy sound (similar to defective audio transformer)	1)	defective "Candohm" resistor. Cut wires in each section for a considerable distance with a sharp knife and solder a 10,000-ohm, 10-watt resistor across the high-voltage section and a 5,000-ohm, 10-watt unit across the low-voltage section. The original terminals of the unit are excellent for connecting lugs
Failure of the tuned filter system	1)	replacement of entire block is necessary. If this is difficult to secure, the following may serve as a substitute: Connect a 0.0005-mfd. condenser from the type '47 tube control grid to chassis, a 0.01-mfd. condenser from one side of switch to chassis, a 12-mfd. electrolytic condenser from the high-voltage end of the "Candohm" resistor to chassis and an 8-mfd. condenser from the type '80 tube filament to the center-tap of the high-voltage winding. If necessary, a tone condenser may also be connected between the tone switch and the chassis (capacity 0.02-mfd.)

TEMPLE

TEMPLE 8-60, 8-61

Inoperative (no plate voltage on detector or first audio tubes)	1)	burned-out transformer primary
	2)	check plate resistors and by-pass condensers in these stages

(Cont'd)

TEMPLE 8-60, 8-61—*(Cont'd)*

Hum	1)	poorly matched '45 tubes
	2)	"shorted" or "open" 0.5-mfd. condenser across tuned choke in filter system
	3)	line voltage too high
	4)	reverse power leads to speaker field
Pilot light flickers	1)	poor voltage regulation of winding which supplies current to the pilot light. Connect the pilot light across the 2½-volt leads for the power tube instead

TEMPLE 8-80

See also Case Histories listed for Temple 8-60, 8-61 receivers

Intermittent operation, Fading	1)	check audio coupling condenser in grid circuit of 47 tube. In this model Temple, the coupling condenser, and resistor for plate of preceding tube are built into a small can on back of chassis; if the resistor checks O.K. it can be left in, so all that has to be done is to clip the wire from can going to the 47 grid, and wire in a 0.01-mfd., 400-volt condenser from the 47 grid to the plate of preceding tube
	2)	"open" bias resistor in 3rd r-f stage

TEMPLE 8-90

Same Case Histories as listed for Temple 8-60, 8-61 receivers

TEMPLE 10

Same Case Histories as listed for "TCA Chassis"

TIFFANY TONE

TIFFANY TONE 157

Dial calibration shifts,	1)	remove chassis and bend dial bracket back a slight amount
Dial works hard	1)	"binding" due to lock washer at point where tuning condenser shaft goes through

TRANSFORMER CORP. OF AMERICA

(See Case Histories listed under CLARION, and TCA)

TRAV-LER

TRAV-LER Receivers (General Servicing Notes)

Noisy (models using yellow coated heavy bus wire around r-f coil for coupling)	1)	wire "shorts" to windings beneath it due to insulation being worn off. Replace the wire with one having better insulation

TRAV-LER C

Weak reception	1)	increase in value of yellow resistor mounted next to red and blue resistor under the chassis. Replace

TRAV-LER 50A

Fading and distortion	1)	the 43 tube goes into oscillation. Reduce screen-grid voltage on 43 tube by inserting a 7,000-ohm resistor in screen-grid lead
Distortion, Choked reproduction	1)	check 0.02-mfd. audio coupling condenser

TRAV-LER 51

Noisy reception	1)	"short" between 75 tube control-grid shield and electrolytic condenser can. Clear this "short"

TRAV-LER 466M

Hum at low volume (O.K. at high volume)	1)	poor "grounding" of a-c switch through shaft. Connect a jumper wire from ground directly to the "ground" side of the switch

TROY

TROY 5L5, 5U5, 15, 15-5

Weak reception	1)	"open" 0.1-mfd. 200-volt condenser in avc circuit

TRUETONE

(In addition to TRUETONE Case Histories which follow, see Case Histories listed under BELMONT and WELLS-GARDNER)

TRUETONE 6K Auto Radio

Crackling and noisy (even when ignition is shut off and car is coasting)	1)	antenna transformer shield can ungrounded. This condition may be remedied by removing chassis and inserting a phosphor bronze spring between the coil can and chassis bracket with long-nose pliers. Most stores handling this set have these springs on hand. If springs are not available, solder short pieces of wire from coil grounds directly to chassis

TRUETONE 7J

Weak reception	1)	"shorted" 0.25-mfd. output tube screen by-pass condenser. Also check 20,000-ohm screen resistor in this circuit and replace if overheated

TRUETONE 80A

Inoperative	1)	check 0.1-mfd. condenser (*C-12*) which by-passes plate-return of the three 24 tubes to ground

TRUETONE 147

Tuning indicator does not close when receiver is tuned to resonance on strong signals	1)	"open" 1-megohm resistor connected from target to plate (resistor mounted in 6G5 socket)

TRUETONE 667

Strong hiss on local station reception	1)	"broken" lead in r-f section of gang condenser—usually between 6K7 r-f tube grid cap and tuning condenser

TRUETONE 689

Distortion, Erratic reception	1)	check for "gassy" 6A7G tube. Try substituting a new one

TRUETONE D-718

Weak reception, Lack of selectivity, Hum from vibrator pack	1)	high-resistance soldered joints. Resolder all filament and grid circuit connections, including all connections to coils

TRUETONE S-719

Noisy reception, Hum	1)	"leakage" or intermittent "short" between wires in battery cable
Whistling or squealing	1)	poor "grounding" contact at 57 tube shield base rivets. Drill out rivets, clean away all corrosion, and replace with bolts

TRUETONE D723

Inoperative, Weak reception, Noisy	1)	check all grid clips for poor contact with tube caps
Weak reception, Distortion, Hum	1)	if all d-c voltages are low, check for "shorted" electrolytic condenser
Whistling or squealing, Distortion	1)	"open" by-pass condensers

TRUETONE D726

Inoperative (only noise heard)	1)	faulty primary winding in 1st i-f coil

TRUETONE D731

See also Case Histories listed for Truetone D723 receiver

Fading	1)	"shorted" filter condenser unit

TRUETONE D745 Auto Radio

Inoperative, Noisy reception	1)	"broken" lead from grid cap of metal tube in corner of cabinet to end section of tuning condenser

TRUETONE D746 Auto Radio

Same Case Histories as those for Truetone D723 receiver

TRUETONE D910, D920, D921, D929—(Series A and Series B)

See also Case Histories listed for Truetone D723 receiver

Hum	1)	reverse line plug
	2)	check filter condensers

TRUETONE D935

Dial drags at either end	1)	"buckled" white celluloid light diffuser. Remove snaps, and glue diffuser to frame to prevent buckling

TRUETONE D941 (Series A and B)

Same Case Histories as those listed for Truetone D723 receiver

TRUETONE D976, D978 Auto Radios

Same Case Histories as those listed for Truetone D723 receiver

TRUETONE D1001

See also Case Histories listed for Truetone D723 receiver

TRUETONE D1020

See also Case Histories listed for Truetone D723 receiver

Inoperative	1)	"open" output transformer winding. To check, pull out speaker plug and check continuity across prongs
Microphonic, Whistling	1)	"loose" volume control shaft. Pull shaft toward you and insert a shim to take up excessive play
Dial cable slips	1)	substitute a stronger spring *Caution*: Do *not* apply rosin to drive cable as this would prevent natural slippage necessary when dial knob is turned past either end, and would result in cable breaking or jumping groove the first time the dial is forced past either end

TRUETONE D1040, DE 3000

Same Case Histories as those listed for Truetone D723 receiver

---

UNITED AMERICAN BOSCH CORP.

(See Case History listings under BOSCH)

UNITED MOTORS *(United Motors Service)*

(See also Case History listings under B. O. P., BUICK, CADILLAC, CHEVROLET, DELCO, OLDSMOBILE, PONTIAC)

UNITED MOTORS 1934 Models

Motorboating, sound, Steady whistle	1)	broken r-f cathode by-pass condenser lead. Look for largest condenser of cluster of three, jammed between lid and the other two

UNITED MOTORS 1935 Models

Weak reception, Selectivity poor	1)	inspect i-f trimmer condensers for melted wax from coil. Clean off wax. Realign i-f

UNITED MOTORS 2035 Auto Radio

Motorboating, sound	1)	"open" 0.06-mfd. condenser in grid-return circuit of i-f tube
"Blocking"	1)	"open" 0.25-mfd. condenser in control-grid return of 1st r-f tube
Vibrator test	1)	connect 8 volts to battery leads, remove 5 ampere fuse in 84 filament lead and shunt an ammeter across the fuse terminals. Place a good 84 in the rectifier socket. The meter should jump to 10 amperes and then drop back to 4.5 if unit is normal. Voltage from plate of 84 to ground is 300 volts a-c
Backlash in drive cable	1)	loosen both set-screws engaging end of drive shaft cable, and tighten them securely (one at a time)

UNITED MOTORS 4037 Auto Radio

Weak reception, Inoperative at the 550-kc end of the dial	1)	defective type 6F7 tube. Replace with new tube
Inoperative	1)	defective vibrator unit. Replace with new vibrator
	2)	dirty vibrator contacts preventing vibrator from starting. Clean contacts if possible; if not replace with new unit
	3)	check buffer condenser and r-f filter condensers for "shorts" or "leakage"
	4)	if tubes, vibrator and condensers check O.K., and the ammeter shows a drain of from 10 to 20 amps., check for "grounded" or shorted secondary turns, or "shorted" turns on primary of vibrator transformer. The primary, which consists of 4 layers of heavy wire, can be re-wound easily
Hum or buzz when volume control is set near zero and no signals are being heard. Upon removing the grid lead from grid cap of 75 second detector AVC and 1st audio tube, this noise ceases	1)	connect a low-resistance lead, such as a piece of braided shield, from the corner of the power supply cover which houses the vibrator, power transformer, etc., to the ground connection on the volume control. (The volume control is mounted on top of the gang tuning condenser.) Be sure to have perfect joints where this lead is connected, as low resistance is essential

UNITED MOTORS 4038 Auto Radio

Intermittent reception, Weak reception, Poor tone quality, Poor bass response	1)	check primary of push-pull input transformer carefully. A voltage analysis will not disclose trouble, as voltages are not affected

UNITED MOTORS 4049, 4050—(32-volt D-C receivers)

Vibrator noise (loudest between about 540 to 800 kc)	1)	securely ground vibrator case to receiver
	2)	replace input filter condenser of B supply
	3)	check vibrator buffer condenser, and replace if leaky. Use only an exact replacement for this condenser if replacement is necessary
	4)	use a good antenna and ground on receiver
	5)	realign receiver completely

UNITED MOTORS 600249 Auto Radio

Same Case Histories as those listed for United Motors 4038 Auto Radio

UNITED MOTORS 980534, 980535—(Buick)

Inoperative	1)	"open" 15,000-ohm 2-watt r-f—osc.—i-f stages screen-supply resistor. Replace

UNIVERSAL

UNIVERSAL 5010

Hum	1)	connect a 0.1-mfd. condenser from "high" side of 400-ohm choke to the output of 25A6 rectifier

U. S. RADIO & TELEVISION

U. S. RADIO & TELEVISION "APEX" Receivers

(For Case Histories of these receivers see also the Case History listings under APEX "Aircell" Models, 7, 7A, 7D, 8, 8A, 9A, 10 Series, 10B, 12, 26, 26P, 27, 27P, 36, 41, 42, 43, 44, 46, 47, 60, 60A, 80, 99 and 120 receivers)

U. S. RADIO & TELEVISION "Battery Super"

Howling	1)	connect a 2-mfd. paper condenser across B batteries. Mount it in the chassis for convenience

U. S. RADIO & TELEVISION "NEW YORKER"

Inoperative (no screen or grid-bias voltage on the type '24A tubes. High plate current on the type '71A tube)	1)	open-circuited 5,000-ohm section of the field coil forming part of the voltage divider system. If possible, locate the break and rewind the coil. If not, replace
Inoperative, Low volume	1)	short-circuited 0.01-mfd. r-f cathode resistor by-pass condenser. Replace with a new unit
	2)	defective 0.05-mfd. detector control grid to cathode isolating condenser. Replace with new unit
	3)	leaky 0.01-mfd. condenser connected between the detector plate and the type '71A control grid. Replace with a 600-volt unit
	4)	leaky 0.1-mfd. condensers connected between the detector, screen-grid and ground and by-passing the type '71A tube control-grid resistor. Replace with new units
	5)	both field windings opposing each other magnetically. Reverse the connections on one of the windings
Electrolytic condensers drawing too much current	1)	leaky units. Replace with 8-mfd., 400-volt units

U. S. RADIO & TELEVISION 5A

Weak reception	1)	check all tubes
	2)	"open" speaker field
	3)	check alignment of receiver. Realign if necessary
Whistling or squealing	1)	check tube shields for good contact with sockets
	2)	"open" r-f by-pass condensers
	3)	r-f plate and grid leads too close together
Hum, Distortion	1)	check tubes
	2)	check audio coupling condenser
	3)	check 5,000-ohm bleeder resistor for change in value

U. S. RADIO & TELEVISION 7

See also Case Histories listed under Apex 7 receiver

Whistling or squealing	1)	check all by-pass condensers for "open" circuit by bridging new ones across them
	2)	see that 2nd i-f plate lead is kept close to sub-panel, and away from 1st i-f grid circuit
	3)	move antenna lead away from the cable

(Cont'd over)

U. S. RADIO & TELEVISION 7—(Cont'd)

Whistling or squealing —(Cont'd)		inside the chassis, and toward the i-f coil cans
	4)	check the 3,000-ohm r-f grid resistor and its 0.1-mfd. by-pass unit. These parts are in lower right-hand corner, facing front of inverted chassis
Distortion	1)	check 47 tube
	2)	re-center speaker cone

U. S. RADIO & TELEVISION 8

See also Case Histories listed for Apex 8 receiver

Fading	1)	faulty 0.04-mfd. coupling condenser connected between 27 second-det. plate and 47 output tube grid. Replace

U. S. RADIO & TELEVISION 10

See also Case Histories listed under Apex 10 Series receivers

Erratic reception	1)	examine resistance strip mounted tight against side of cardboard electrolytic condenser upon which the AVC circuit resistors are mounted. There is often sufficient leakage between the resistance strip and the condenser to cause trouble. Insulate with cardboard
Overloading	1)	check 200,000-ohm resistor in plate circuit of AVC tube
	2)	check condenser from plate of AVC tube to cathode
Jumpy volume control	1)	gassy '27 tube in 1st audio stage. Replace
Hum	1)	check electrostatic shield of power transformer, making sure it is grounded
	2)	check 25,000-ohm plate filter resistor in 2nd detector plate circuit for "short"
	3)	"open" or "shorted" 0.06-mfd. condenser which tunes the main filter choke
Hum (volume control will not reduce volume to zero)	1)	"open" 8-mfd. condenser under resistance strip in center of chassis. Replace

U. S. RADIO & TELEVISION 12 Class "B"

Inoperative unless signal is strong and Q control is on full	1)	locate point where QAVC tube cathode and suppressor are tied together and connected at junction of the 850 and 5,000-ohm sections of Candohm voltage-divider. Shift this connection to the other end of the 5,000-ohm section of the voltage divider

U. S. RADIO & TELEVISION 24

Inoperative, Weak reception (on low-freq. half of band)	1)	"open" 4-mfd. electrolytic condenser connected between chassis and high-voltage center-tap of power transformer (across 500-ohm bias resistor of 47 tube)
Inoperative, Hum	1)	"open" second filter condenser
Intermittent operation	1)	check top i-f transformer at rear of chassis for poor connection between trimmer and grounding lug
Whistling or squealing	1)	"back off" the setting of the oscillation control condenser until oscillation just ceases. (This oscillation control is the rear screw on top of the i-f-oscill. assembly)

(Cont'd)

U. S. RADIO & TELEVISION 24—(Cont'd)

Volume control ineffective on strong signals	1)	replace control with left-hand tapered 5,000-ohm carbon volume control and reverse the center and "high" leads. (In the original unit, the antenna went to center arm)

U. S. RADIO & TELEVISION 25 SERIES

Code interference	1)	overproduction of harmonics by the oscillator, causing strong short-wave code signals to be heterodyned. The tuned-in broadcast signal heterodynes these signals at audio frequencies, making them audible in the receiver. *Remedy*: increase the value of the type '57 oscillator first detector tube cathode bias resistor, by placing a variable resistor in the circuit and varying the bias until all the code interference disappears. A fixed resistor may be installed in place of the variable one when the proper value is found
Weak reception, Distortion, Whistling or squealing	1)	check 57 and 58 tubes. Replace if necessary

U. S. RADIO & TELEVISION 26, 26P

Inoperative	1)	"open" section in voltage divider
	2)	check filter condensers
	3)	if r-f screen voltage is abnormally low, check for "shorted" 0.4-mfd. screen by-pass condenser. Use 0.5-mfd. replacement unit
Intermittent volume	1)	"open" detector by-pass condenser
Whistling or squealing (abnormally high screen voltages)	1)	"open" 2,560-ohm screen bleeder resistor. A 2,500-ohm unit may be used for replacement
Power transf. overheats	1)	inspect for "shorted" plate leads between transformer and '80 tube socket

U. S. RADIO & TELEVISION 27, 27P

See also Case Histories listed for Apex 27, 27P receivers

Inoperative (no plate voltage on '27 tube. No screen voltages on '24 tubes)	1)	"open" 8,400-ohm voltage divider section. Replace with new unit
Intermittent operation	1)	leakage between terminals of wet electrolytic condensers. Liquid on top of can causes "short" between positive terminal and can. Mount with vents on top. If boiling continues, replace both 8-mfd. sections

U. S. RADIO & TELEVISION 28, 28A, 29

Whistling or squealing, High-pitched whistle	1)	decrease in value of 0.04-mfd. first audio by-pass condenser. Replace with a 0.05-mfd. unit

U. S. RADIO & TELEVISION 31

Inoperative	1)	check 6,400-ohm section of voltage divider. Replace with 5-watt wire-wound unit
Hum	1)	"open" electrolytic condenser
	2)	"leaky" electrolytic condenser

U. S. RADIO & TELEVISION 34

Intermittent reception	1)	try new suppressor resistors in control-grid circuits of '35 tubes
	2)	check '35 tubes for gas
	3)	faulty 200,000-ohm grid return filter connected from AVC plate to the grid return of the 35 tube. Replace with a 100,000-ohm unit

U. S. RADIO & TELEVISION 48

See also Case Histories listed for Apex 48 receiver

Whistling or squealing	1)	check all by-pass condensers for "open"
	2)	check detector r-f choke located beneath chassis in right rear corner when looking from front
Aligning receiver	1)	to prevent oscillation when condenser gang cover is removed, rotate the cover plate half way around (after it is removed) and then place it on top of the chassis so that the tube shield plates are placed between control-grid leads of screen grid tubes, at the same time, moving it back far enough to leave condenser gang uncovered
Hum, Noisy	1)	intermittent "grounding" of pilot-light bracket to chassis due to shifting of fibre insulating washers

U. S. RADIO & TELEVISION 400 Chassis

Inoperative on lower frequencies until set warms up (due to oscillator not functioning)	1)	connect a 0.1-mfd. tubular condenser from low-potential end of oscillator to chassis
	2)	check filter condensers, and replace if below normal capacity, or "leaky"

U. S. RADIO & TELEVISION 700

Whistling or squealing	1)	try new 57 and 58 tubes
	2)	check all by-pass condensers for "open"
	3)	if condensers and tubes are O.K., check for coupling between the plate and grid leads by separating and pushing them toward the chassis

---

VICTOR

(See Case History listings under RCA-VICTOR and RCA-VICTOR (*CANADIAN*)

WEBSTER-CHICAGO

WEBSTER-CHICAGO 210 Automatic Record Changer

Motor inoperative (even when disconnected from all other wiring and connected directly to line)	1)	trouble in motor windings. Unless damage is easily seen and repaired, return it to factory for repair or replacement
Motor slow in starting	1)	check oiling. It may not have been properly done before; old oil may have become "gummy"

(Cont'd)

WEBSTER-CHICAGO 210 Automatic Record Changer —*(Cont'd)*

Mechanism slow in starting, (or "stalls" during a change cycle), but slight forward push with hand starts it again	1)	failure to lubricate properly
	2)	loose set-screws
	3)	weakness of drive. Line voltage may be abnormally low, or motor windings damaged
Squeaks or other noises during playing of records	1)	check lubrication
	2)	see that all set-screws are tight
	3)	center the records on the spindle
Motion of pickup toward record pin does not trip changer mechanism	1)	(Only on models not having trip adjustment hole *AR*.) It may be found that, instead of trigger being actuated, there is stretching of swivel spring *CK*, allowing the spreaders to open. *Increase tension of the spring*, by bending the lug on either spreader slightly. If this increased tension causes needle to jump across the record, needle may be a little out of vertical, radially—it may lean toward center of record. To remedy this, grasp pickup arm and twist it, very slightly, in a clockwise direction (looking from needle end) so that it stands vertical, or even a little in outward direction.
	1)	if trigger is being properly actuated, probably cam lever *OS* is binding against subplate *CU*. Look for dirt or obstructions; see that pawl *DH* and trigger *OP* are working freely on their rivets. If the lever engages the pawl so that lift *CV* forces roller *DJ* up into the under groove on cam gear, and if setscrews are tight, the change cycle must operate, as cam gear turns.
Pressing button "R" does not trip changer mechanism	1)	check key control unit *FM*: see whether there is an obstruction or a bent part which prevents operation of button "*R*" clear down to the end of its travel.
	2)	examine reject rod *FI*. If it does not trip, even when properly revolved by complete depressing of button "*R*," the rod has probably been bent, and must be restored in same way. *Grasp the two ends and twist it* slightly.
	3)	if trigger *OP* is being properly actuated but without starting a change cycle, see directions above.
Pressing button "M" fails to put changer mechanism out of action so as to enable manual operation	1)	first see that button goes clear down; then follow its action through manual rod *FH*
Motor stops immediately when changer switch is turned off during a change cycle (instead of continuing to run, as it should, until needle is again upon a record, and then stopping), Turning on-off switch fails to stop changer at all	1)	either of these two conditions would indicate failure of cycling switch *EH*. Cycling switch operates normally to short-circuit the manual on-off switch (which may be located in position shown at *FA* or elsewhere) during change cycle only. Such damage to cycling switch (not likely to occur) would necessitate returning either the subplate assembly or the entire changer to factory
Needle lands properly on record but fails to move into record groove	1)	pickup arm is normally impelled toward center of records by lead spring *ER*. Should a slight increase in its tension be found necessary, this can be easily obtained by bending the lug (to which it is attached) down against main plate. If tendency then appears for needle to jump across record, check angle of needle

(Cont'd over)

WEBSTER-CHICAGO 210 Automatic Record Changer —(Cont'd)

Records fall unevenly upon turntable	1)	seldom objectionable (some unevenness may even be advantageous); this is due to record pin not being correctly centered between changer posts. If necessary, it can be corrected as described above
Last record drops on one side only	1)	this suggests a changer post bent out of perpendicular to main plate. *Test as directed above.* If post must be straightened, be careful not to bend other parts
Changer continues cycling	1)	probably due to failure of lift *OY* to be drawn back out of engagement with cam gear. Check the various rivets at which motion occurs, to find the point where friction of binding is interfering with freedom of motion
Record is driven, but not heard, or not heard with proper volume	1)	see that pickup cord is plugged in. Check amplifier and speaker and connections to them, thoroughly. If the trouble is still suspected in pickup, test its output with a *vacuum-tube voltmeter.* Playing an average record, output should test 1 to 2.5-volts if pickup cartridge is of crystal type, or 0.5-volt if of magnetic type. If pickup cartridge is found not to deliver proper output, remove it and install another
Selector plate fails to separate bottom record from stack	1)	this is due either to a badly warped condition of the record, or to its being of a thickness very considerably different from those now in standard use. The design of both selector and shelf plates is such as to accommodate a maximum variation in thickness and flatness of records, but certain records may be found which are so far out as to be impracticable for use in automatic changers.
Landing position of needle is not constant, or pickup arm cannot be adjusted to set needle down in starting groove of record	1)	in the first production of the automatic record changer the pickup arm may display the following symptoms: a) After the pickup arm has been set for the correct landing position, the needle does not lower consistently to the starting groove of a record during the playing of any one size of records. b) The needle lowers so far away from the starting groove of the record that turning the needle landing adjusting screw does not bring the needle to the starting groove. In early production, the pickup lead was permitted to hang down directly below the foot of the pickup. In such instances, the lead may become entangled with the rotating mechanism for the pickup arm. This will produce either one of the above actions. To remedy the condition, clamp the pickup lead to the bracket, leaving enough slack to permit free action of the pickup arm. That portion of the lead under the clamp should be covered with tape. The clamping arrangement consists of a small clamp, a No. 6 lockwasher, and a 6-32 self-tapping machine screw.
Pickup arm does not set needle down in starting groove of both 10" and 12" records	1)	it may be found that any one setting of the needle-landing adjusting screw will not cause the phono pickup arm to set the needle down in the starting groove for both 10- and 12-inch records. This condition may be remedied as follows: Set the automatic record changer for 10-in. record operation. Turn the needle landing adjusting screw so that the pickup arm sets the needle down in the starting groove of a 10-in. record. Replace the 10-in. record with a 12-in. record and set the automatic record changer for 12-in. record operation. Start the mechanism. Check the landing position of the needle

---

WELLS-GARDNER

(In addition to the following listings, see Case Histories listed under GULBRANSEN and TRUETONE)

WELLS-GARDNER 1937 Models

Weak reception in auto radios	1)	if volume control resistance checks less than rated value, replace

WELLS-GARDNER 1938 and 1939 Models

Distortion and overloading on strong signals in receivers which use the 6U5 and 6AB5 tuning eye tubes	1)	grid current flowing in the tuning eye tube. Try one or more new tubes and check results. (The control-grid of triode section of 6U5 and 6AB5 tubes is connected to avc circuit, and grid current will affect the avc voltage)

WELLS-GARDNER 5 Tube AC-DC Models

Distortion at low volume levels	1)	due to variations in 6J7 tube characteristics. Change 0.5-meg. det. screen series resistor *R-5* to a 0.7-meg. resistor
Electrolytic condenser and rectifier tube break down repeatedly	1)	due to surge voltages. Add a 25-ohm resistor in series with plate circuit of 25Z6G rectifier tube

WELLS-GARDNER ODM (10 Tube Model)

Inoperative	1)	"shorted" 0.1-mfd. 6K7 plate circuit bypass condenser (connected to last i-f transformer)

WELLS-GARDNER OEL

Distortion on strong signals when tuned exactly to resonance (reception normal when detuned slightly)	1)	one i-f transformer out of alignment. Realign
Distortion (at all times)	1)	check for change in value of 25,000-ohm 3-watt bleeder resistor (*R-14*) connected from 6F6 screen-grid to 6C5 1st a-f tube cathode. Use 10-watt wire-wound replacement unit

WELLS-GARDNER A1

See also Case Histories listed for Wells-Gardner A4, A5 receivers

Low volume, Reception cuts out, Noisy volume control	1)	disconnect volume control. Set arm anywhere between high-volume end and center position. Connect a 45-volt battery from movable arm to ground terminal of control to burn out plating "whiskers"
Noise when tuning in a signal with a telephone dial button	1)	if noise occurs on all buttons, check for poor contact between flat contact spring and the contact ring. Clean the flat contact spring and contact ring to insure a good electrical connection. Ordinary cleaning fluid may be used and will be effective in most cases in cleaning the surface without affecting the plating. If the contact is still not satisfactory, a piece of very fine emery cloth may be used
	2)	if noise occurs on any one button only, it is due to a poor contact between the pulley ring stud, spring, contact washer, and contact ring. Clean all of these parts so as to provide good electrical connection

WELLS-GARDNER 1A28

Hum with signal
1) interchange 6SK7 first a-f tube with the 6SK7 r-f and 6SK7 i-f tubes. Note results. The original 6SK7 first a-f tube may be left in either the r-f or i-f tube sockets if the arrangement reduces the hum
2) if the foregoing does not reduce the hum sufficiently, try several new 6SK7 first a-f tubes. Use the one which reduces the hum to a minimum

WELLS-GARDNER 1A29

Distortion on signals of moderate volume
1) change diode-load resistor *R-19* from 250,000-ohms to value that is most suitable to remedy this condition. Try several values near 250,000-ohms

Hum modulation
1) remove resistor R-1 (in series with avc connection to antenna coil) from circuit. Disconnect avc line from terminal *D* of antenna coil, and connect terminal *D* to *ground* instead. Remove by-pass condenser *C-6* (now connected between terminal *D* and ground)

Connect avc line (which was formerly connected to the *D* terminal of the antenna coil and *C-6*) through a 3-meg. resistor *R-46* to terminal *G1* of the 6SK7 r-f tube

Connect a 0.0005-mfd. condenser *C-59* in series with the lead connecting grid No. 1 of the 6SK7 r-f tube to the gang condenser stator

WELLS-GARDNER 02A

Volume control does not reduce volume completely, Distortion at low volume settings
1) disconnect suppressor grids of i-f tubes from series resistor *R-13*, and connect the suppressors to cathode. Add 5-mfd. or more in parallel with 0.25-mfd. cathode by-pass condenser (*C-5*) for the 55 second detector tube

WELLS-GARDNER A2

Reception cuts off, Low volume, Noisy volume control
1) disconnect volume control. Set arm anywhere between high-volume end and center position. Connect a 45-volt battery from movable arm to ground terminal of control to burn out plating "whiskers" Connect volume control back into circuit

WELLS-GARDNER 2CM Series

Excessive a-c hum
1) inductive pickup by the type '6F6 driver lead which is located alongside the lead running between the choke and the type '80 socket in the center of the chassis. Separate these leads as far as possible
2) unbalanced plate current condition in the output stage, employing types '6F6 tubes. In no case should their plate currents differ by more than 10-milliamperes. If they do, try substituting several different tubes until the proper balance is obtained

WELLS-GARDNER 2DL

Hum
1) check volume control lugs for "grounding" to flat portion of metal chassis wall which supports rubber mounting foot
2) the bottom plate under the chassis must be under the r-f end of the chassis and away from the filter choke. If it is in the center or left side (from the back of the chassis) move it to the right side a half inch from the mounting bolt holes

(Cont'd)

WELLS-GARDNER 2DL—*(Cont'd)*

Intermittent noises
1) poor connection in Candohm resistor used for bias of AVC and audio tubes. Usually the trouble lies in the first-audio 6C5 cathode connection. Install a 156.5-ohm resistor between 6C5 first-audio and 6C5 AVC cathodes to replace faulty section

Volume changes slightly accompanied by "popping" noise
1) faulty high-fidelity switch located on tone control. Replace

WELLS-GARDNER A3

See also Case History listed for Wells-Gardner A2 receiver

Distortion at low volume
1) realign entire receiver, particularly the i-f stages (with "fidelity" control set at "sharp tuning")

WELLS-GARDNER A4

Telephone dial drive cord slipping
1) if cord slips on tuning shaft pulley, adjust the drive and tension pulley. Loosen tension pulley bracket screw and adjust pulley assembly until desired tension is obtained

Greasing and oiling telephone dial mechanism
1) use light grease on pulley ring shaft and on teeth of pulley ring. Use light oil on drive shaft assembly bearing (being careful not to get any on the drive cord)

WELLS-GARDNER 04WG-610, 04WK-611 (Series 6D3-1)

Whistling or squealing all over dial— or only at low-freq. end
1) connect a 170-ohm ¼-watt resistor between 12SK7 i-f tube cathode and B—

WELLS-GARDNER 04WG-614, 04WG-619, 04WG-621, 04WG-621NI (Series 6A43-1)

Hum
1) reversed speaker plug connections. The *brown* lead should be connected to the plate and the *green* lead to the B-plus

Circuit changes for improving performance of 6A43-1 receiver (Early-runs)
1) add a 1.5-meg. resistor in series with *No. 2* terminal on band switch (Section No. 1) and the ungrounded terminal of the phono socket. Also connect a 0.5-meg. resistor between the ungrounded terminal of phono socket and ground

WALLS-GARDNER 04WG732

"Needle scratch"
1) connect a 100,000-ohm resistor between ungrounded side of phono socket and the phono switch to reduce needle scratch on high-impedance pickups
2) *No. 1* terminal of the speaker and record cutter socket (which is now "open") should be connected to the *positive* B-voltage supply at the high-voltage side of filter resistor *R-18*

WELLS-GARDNER 05A (AC-DC)

Excessive hum
1) connect a 4-mfd. electrolytic condenser between second-detector cathode and ground

WELLS-GARDNER A5

Same Case Histories as those listed for Wells-Gardner A4 receiver

WELLS-GARDNER 5B12-1

Tuning drive cord slips
1) replace with new type 34-inch drive cord (18 to 30 lb. test)

WELLS-GARDNER 5C16-7

Motor noise pickup from passing cars
1) replace present antenna input circuit so it uses a 35-mmfd. and 300-mmfd. condenser and 1-meg. resistor not previously used. (See manufacturer's diagram for "Issue B" of this receiver)

WELLS-GARDNER 5D

Weak reception
1) "open" or "shorted" 42 power tube cathode by-pass condenser *C-24*
2) "open" or "shorted" 42 power tube plate-to-cathode by-pass condenser *C-26*

Difficult to align set on short-waves
1) check for faulty 1st detector short-wave trimmer condenser

Poor tone
1) **change the grid bias on the type '19 output tubes from 6 to 4½ volts, by connecting the white lead marked "C-6" to the 4½-volt tap on the "C" battery**

Noisy
1) replace the 50-mmfd. condenser between 34 i-f tube plate and the grid of second detector. This is a special "capacity-wire" type condenser, but can be replaced with an ordinary 0.0001-mfd. mica condenser

WELLS-GARDNER 5D2

Hum modulation (especially on weak signals)
1) disconnect the side of the 0.05-mfd. grid-return by-pass condenser (*C-1* in 5D2 and 6A26 receivers, and *C-2* in 6A27 receiver) which now connects to the chassis ground, and connect this side of the condenser to B— (the line-plug end of the 12SQ7 tube filament) instead

WELLS-GARDNER 5E

Noisy
1) replace special 50-mmfd. capacity-wire type condenser connected between 34 i-f tube plate and second detector grid. (Replace with 100-mfd. mica condenser)

WELLS-GARDNER 06A

Poor reception (as though over-biased)
1) change negative 6-volt "C" connection to negative 4½ volts

WELLS-GARDNER 6A26, 6A27

Hum (steady)
1) try new 35L6GT output tube

Modulation hum on weak stations
1) try new 12SK7 i-f tube
2) wrap dial lamp socket mounting bracket with insulating tape to insulate dial lamp clip from the bracket
3) disconnect the 0.05-mfd. antenna condenser (*C-1* in 6A26 receiver, and *C-2* in 6A27 receiver) from the chassis ground, and connect this side of condenser to B— instead
4) try new 6AB5 tuning indicator tube
5) dress lead from 0.004-mfd. or 0.005-mfd. first audio coupling condenser to the volume control as far away from filament leads as possible
6) in 6A26 receiver, a ground connection should be used with an external antenna

Distortion and blocking
1) "open" 500,000-ohm output tube grid resistor *R-10*

WELLS-GARDNER 6B7

Circuit changes for improving performance of Early-run receivers
1) change 1,950-ohm resistor *R-12* (in series with filament circuit) to 2,200-ohms
2) connect a 750-ohm resistor (*R-27*) across one section of 3Q5GT output tube to equalize currents through both sections
3) remove the two shunt resistors (800-ohm *R-19* and 400-ohm *R-18*) from across the four 1½-volt filaments. (The connecting point between these two resistors established the grid bias voltage for the output tube.) Shunt the four tube filaments with a single 1,200-ohm resistor (*R-26*)
4) shunt a 1,500-ohm resistor (*R-25*) across the first-det. filament. Shunt two 340-ohm resistors (*R-23* and *R-24*) in series across the 1H5GT second detector filament. The connecting point between these two resistors now establishes the grid bias voltage for the output tube

WELLS-GARDNER C6-A Auto Radio

Replacing dial drive cord
1) remove celluloid dial scale. Open clamps on back of dial pointer in order to remove old drive cord.

It is not necessary to remove dial and drive bracket assembly to replace drive cord.

Tie a knot with a small loop at one end of new drive cord. Slide a ½ inch length of fabric tubing on the cord. Tie free end of drive cord to tension spring. The distance between knots should be 28⅝ inches.

Turn gang condenser to full "open" position.

Place looped end of drive cord over hook on condenser drive drum. Bring cord up through slot in drum rim.

Turn drive drum to position where hook and spring are near end.

Wind one turn down and around drive drum *A* and around pulley *E*. Wind 3½ turns on tuning control shaft *C*, progressing from a point midway between the two bracket arms toward the chassis. Bring cord under pulley *D* and around pulleys *E* and *F*. See that the fabric tubing is now between pulleys *E* and *F*. Bring the drive cord to the rear around drive drum *A* and through the slot in the drum rim as shown.

Turn the gang condenser to full open position and place the free end of the tension spring over the hook on drive drum *A*.

Dial pointer adjustment: Mount the celluloid dial scale on the dial bracket. Tune in a signal of known frequency near one end of the dial scale. Move the pointer assembly to this frequency on the dial scale and tighten the clamps with long nose pliers.

WELLS-GARDNER 6C1 Auto Radio

Weak reception (resistance of volume control element way below normal value)
1) disconnect all leads from volume control. Set arm anywhere between high-volume end and center position. Connect a 45-volt battery directly between movable arm and ground contact of control to burn out any metallic plating "whiskers" inside. Reconnect control

WELLS-GARDNER C69 Auto Radio

Circuit changes for improving performance of Early-run receivers
1) remove 100-mmfd. condensers *C-17* and *C-27* (they are not to be replaced by any part)
2) remove dual tubular condenser (*C-29A*, *C-29B*, 0.05-mfd. 180-volts) located within filter unit shield. Remove 210-mmfd. condenser *C-26* and connect it to replace the *C-29A* section of the dual tubular unit. Replace the other section *C-29B* of the dual tubular unit with a new 0.5-mfd. 180-volt tubular condenser *C-29*. Connect a new 200-mmfd. mica condenser *C-40* from B+ side of the 40-mfd. filter (*C-28*) to ground

WELLS-GARDNER 6C17, 6C18

Circuit changes for improving performance of Early-run receivers	1)	increase oscillator grid resistor from 20,000 ohms to 40,000 ohms
	2)	decrease value of oscillator plate resistor from 20,000 ohms to 15,000 ohms
	3)	disconnect r-f screen from the modulator screen, and connect it to the i-f plate. In the 6C18 receiver only, increase value of modulator screen resistor from 10,000 ohms to 12,000 ohms

WELLS-GARDNER 6F

Crackling noises (all voltages and currents normal)	1)	replace Candohm resistor *No. 43X46*. Its total resistance is 6630 ohms
Excessive hum	1)	defective types '6B7 and '6F7 tubes. Substitute new tubes and note effect
	2)	insert a cardboard shim $\frac{3}{32}$-inch thick under choke *L4*
	3)	replace the 4-mfd. 150-volt electrolytic condenser with a 12-mfd. 300-volt unit

WELLS-GARDNER 6J Auto Radio

Same Case History as listed for Wells-Gardner 6C1 Auto Radio receiver

WELLS-GARDNER 06Z Auto Radio

Set dead, No plate voltages	1)	defective filter condenser. Replace with new unit
	2)	short-circuited 0.02-mfd. condenser connected across the power transformer secondary. Replace with new unit
	3)	defective vibrator. Replace vibrator and transformer with new type units
Excessive vibrator noise in speaker	1)	ground the pigtail on the antenna lead
	2)	broken lead at terminal of 0.02-mfd. condenser across the power transformer secondary. Solder broken lead and anchor bulk of the secondary to power transformer
	3)	cathode leakage or short-circuits in tubes. Replace tubes one at a time, noting the difference in the noise
Whistling or squealing	1)	open-circuited lead of 0.25-mfd. r-f cathode condenser. Replace with new lead or solder the open circuit. Also anchor bulk of condenser to tuning condenser frame
Speaker rattle	1)	dirt in speaker. Replace with new speaker and re-install set so that speaker is facing down or out and *not up*
Set locked in both the locked and unlocked key positions	1)	warped cast aluminum strip, thus locking volume control in both key positions. Bend strip so as to clear set-screw in unlocked position only

WELLS-GARDNER 07A

Inoperative (all d-c voltages low)	1)	"shorted" tone-control condenser
	2)	faulty insulation in 150,000-ohm tone control. Replace
	3)	check 18,000-ohm sections of voltage divider. Replace if faulty

WELLS-GARDNER 7A41-3, 7A41-5

Needle scratch on phono	1)	connect a 100,000-ohm resistor between ungrounded side of phono socket and phono switch
Circuit improvement	1)	connect No. 1 terminal of speaker and record cutter socket to *positive* B-voltage supply at high-voltage side of filter resistor *R-18*

WELLS-GARDNER 8A30, 8A31, 8A32, 8A33, 8A34, 8A35, 8A36, 8A37

Modulation hum	1)	interchange 6SK7 first a-f tube with the 6SK7 r-f and 6SK7 i-f tubes. Note results. If hum has been reduced, leave tubes this way If hum still persists, try out several *new* 6SK7 first a-f tubes. Use one which reduces hum to a minimum

WELLS-GARDNER 9A46-3, 9A46-4 Series

Dead spots on low-freq. end of "D" (13 to 16 meter) band	1)	connect an 8-ohm ½-watt carbon resistor in series with terminal *No. G1* of 6SA7 oscillator tube and the 50-mmfd. condenser (*C-29*)
Circuit changes to improve tone quality in Early-run receivers	1)	change 15,000-ohm resistor *R-9* to a 7,000-ohm ½-watt carbon unit. Change 0.04-mfd. condenser *C-39* to a 0.1-mfd. 180-volt unit. Connect a 0.1-meg ½-watt carbon resistor from junction of condeners *C-38* and *C-39* to ground

WELLS-GARDNER 9B

Poor tone	1)	change the grid bias on the type '19 output tubes from 6 to 4½ volts, by connecting the white lead marked "C-6" to the 4½-volt tap on the "C" battery

WELLS-GARDNER A-12

Distortion after receiver has been operating about 10 minutes	1)	grid current flowing in 6U7G r-f and i-f tubes. Change 4-meg resistor *R-14* to a 2-meg. unit
	2)	replace either the 6U7G r-f or i-f tubes or both of them

WELLS-GARDNER 20 Series

Inoperative (no plate voltage on first '27 a-f tube), Weak reception	1)	"open" 40,000-ohm *yellow* carbon resistor mounted on voltage divider, feeding primary of transformer connected to first '27 a-f tube. Use a 2-watt replacement resistor. Also replace the 0.5-mfd. by-pass unit in the condenser block (*red* wire) with an external 0.5-mfd. unit rated at 600 volts
Intermittent reception, "Fuzzy" reception	1)	check 0.1-mfd. 600-volt by-pass condenser
	2)	check 0.05-mfd. by-pass condenser

WELLS-GARDNER 20C5

Same Case Histories as those listed for Wells-Gardner O-C Series

WELLS-GARDNER 24

Weak reception, Distortion — 1) check 0.01-mfd. condenser (Part *No. 46X120*). Replace with 600-volt unit

Distortion at low volume (O.K. on full volume) — 1) remove 200-ohm bias resistor for 30 first a-f tube and 19 output tube. Resistor is located in the genemotor. Replace with a 100-ohm 2-watt unit

WELLS-GARDNER 40, 40A

Severe distortion at low volume — 1) remove 200-ohm bias resistor for 30 first a-f tube and 19 output tube. Resistor identified by the double layer of insulating paper at these points. Interaction takes place between the AVC, volume control and grid bias due to leakage between these lugs

2) change the 40,000-ohm resistor *R-16* to one of 500,000 ohms

WELLS-GARDNER (Truetone) 052 Series

Inoperative (high screen and cathode voltages) — 1) due to change in value of 40,000-ohm resistors mounted on terminal strip in i-f transf. can. Replace both resistors and volume control if necessary

Weak reception — 1) defective 0.1-mfd. condenser from type '35 screen to ground

2) replace 250,000-ohm ⅛-watt resistor connected from second detector '57 tube plate to the '80 tube filament (even if it tests O.K.). On load it sometimes drops the plate voltage from 180- to 100-volts. Use a one-watt carbon replacement resistor

3) corroded contacts on wave change switch. Take switch apart and clean all contacts

WELLS-GARDNER 62-403

Distortion (sounds like receiver overloading) — 1) replace 5.0-mmfd. i-f coupling condenser *C-33*

WELLS-GARDNER 65

Intermittent audio howl — 1) replace the double 12—12-mfd. audio electrolytic condenser with new unit

Low volume — 1) defective coupling condensers in series with volume control. Replace condensers

WELLS-GARDNER 93WG663, 93WG668

Same Case Histories as those listed for Wells-Gardner 6B7 receiver

WELLS-GARDNER 619, 621, 621NI

Hum — 1) reversed speaker plug connections. *Brown* lead should be connected to plate, and *green* lead to B-plus

WELLS-GARDNER S732 Series

Same Case Histories as listed for Wells-Gardner 06Z Auto Radio receivers

WELLS-GARDNER 752, 754, 756

Weak reception — 1) check volume control for grounded rotor

WELLS-GARDNER 872 SERIES

Broad tuning, Low volume — 1) poorly soldered connections at r-f or i-f coils. Re-solder all connections.

2) defective type '57 AVC tube (even though it may test O.K.). Replace

3) receiver circuits out of alignment. When re-aligning the receiver, connect a 0.05-mfd. condenser between the signal generator output and the first detector tube grid. The ground of the signal generator should connect to chassis

---

WESTERN AIR PATROL

WESTERN AIR PATRON 7M3C

Weak reception — 1) replace 0.25-mfd. condenser in plate filter between two 70,000-ohm resistors supplying 6F5 tube

---

WESTERN AUTO SUPPLY CO.

(See Case History listings under TRUETONE & WELLS-GARDNER)

WESTINGHOUSE *(AMERICAN)*

(The Case Histories of WESTINGHOUSE (*CANADIAN*) receivers are listed on the pages immediately following the end of this WESTINGHOUSE (*AMERICAN*) group)

See also the WESTINGHOUSE receiver Model-Number Cross-Indexes in *Sections 5 and 6* of this *Handbook*

WESTINGHOUSE WR-4

See also Case Histories listed for RCA Radiola 48 receiver

Whistling or squealing, Intermittent noise, Noisy volume control action — 1) faulty volume control. Try new one. (The screen-grid section of the new control has a different resistance value then the old one, and has a reversed taper.) This necessitates reversal of the two outside connections on the screen potentiometer, and removal of the 12,000-ohm *gray* resistor which shunts this section of the volume control

WESTINGHOUSE WR-5

See also Case Histories listed for RCA Radiola 80 receiver

To improve sensitivity — 1) remove shield from first i-f transformer

Weak reception, Poor tone quality — 1) check for "grounding" of strip of resistors under chassis, lowering the C bias to the power tubes (grounding may only occur when set is warm and resistors are expanded)

Distortion — 1) substitute an 8,000-ohm resistor for the 10,000-ohm unit connected between the cathode of the 2nd detector and ground

Severe crackling noise — 1) partially short-circuited turns in i-f transformers as a result of glue from labels pasted on them corroding the insulation of the wire

WESTINGHOUSE U6F Chassis

Distortion — 1) high-resistance "leakage" in 0.01-mfd. 200-volt coupling condenser. Replace

WESTINGHOUSE WR-6

See also Case Histories listed for RCA Radiola 82 and RCA Radiola 82R receivers

Weak reception, Poor tone quality	1)	check for "grounding of strip fo resistors under chassis, lowering the C bias to the power tubes (grounding may only occur when set is warm and resistors are expanded)
Severe crackling noise	1)	partially "shorted" turns in i-f transformers as a result of glue from labels pasted on them corroding the insulation of the wire
	2)	poor "grounding" connection of electrostatic shield in power transformer. Clean grounding lead to this shield, and ground securely to receiver chassis

WESTINGHOUSE WR-7

See also Case Histories listed for RCA Radiola 86 receiver

Weak reception, Poor tone quality	1)	check for "grounding" of strip of resistors under chassis, lowering the C bias to the power tubes (grounding may only occur when set is warm and resistors are expanded)
Severe crackling noise	1)	partially "shorted" turns in i-f transformers as a result of glue from labels pasted on them corroding the insulation of the wire
	2)	poor "grounding" connection of electrostatic shield in power transformer. Clean grounding lead to this shield, and ground securely to receiver chassis

WESTINGHOUSE WR-8

Weak reception, Poor tone quality	1)	check for "grounding" of strip of resistors under chassis, lowering the C bias to the power tubes (grounding may only occur when set is warm and resistors are expanded)
Severe crackling noise	1)	partially "shorted" turns in i-f transformers as a result of glue from labels pasted on them corroding the insulation of the wire

WESTINGHOUSE WR-10, WR-10A

See also Case Histories listed for RCA R-7 and RCA R-7A receivers

Noisy reception	1)	defective volume control
	2)	peeling condenser plates—burn with high voltage (all terminals disconnected)

WESTINGHOUSE WR-12

See also Case Histories listed for RCA R-9 receiver

Inoperative	1)	"open" first i-f transformer secondary winding. Replace transformer
	2)	"open" or change in value of 8,000-ohm resistor in first r-f, oscillator, and first i-f cathode circuits . Replace

WESTINGHOUSE WR-13

Same Case Histories as listed for RCA RE-16 receiver

WESTINGHOUSE WR-14

See also Case Histories listed for RCA R-5 receiver

Volume of strong locals cannot be reduced by volume control (even with antenna disconnected)	1)	the r-f coil and volume control leads are unshielded, supplying sufficient signal pick-up. Shield r-f coil with large tube shield or other shield can. Also replace 8-mfd. wet electrolytic with dry unit. Shield control-grid lead of first 24 r-f tube

WESTINGHOUSE WR-15

See also Case Histories listed for RCA R-11 receiver

Inoperative until AVC tube is withdrawn	1)	leaky 0.1-mfd. AVC tube grid-return by-pass condensers
Weak, Insensitive	1)	leaky 0.1-mfd. AVC tube grid-return by-pass condensers
Fading	1)	open-circuited 5-megohm resistor
	2)	leaky 0.1-mfd. AVC tube grid-return by-pass condensers
Distortion at any volume level	1)	carbonized voltage divider resistors. Install wire-wound unit for screen-drop resistor
Distortion at low volume	1)	primary-secondary "short" in push-pull input transformer
Noisy tuning, Whistling or squealing	1)	corroded condenser-gang rotor contacts
Motorboating sound	1)	"open" by-pass condenser in pre-selector or first-detector stage
	2)	tuning condenser rotor wipers not making good contact
	3)	"open" or "shorted" resistors or condensers in AVC grid-return circuits

WESTINGHOUSE WR-15A

Same Case Histories as those listed for RCA R-10 receiver

WESTINGHOUSE WR-16

Same Case Histories as those listed for RCA RO-23 receiver

WESTINGHOUSE WR-17

Same Case Histories as those listed for RCA R-4 receiver

WESTINGHOUSE WR-18

Same Case Histories as those listed for RCA R-8 receiver

WESTINGHOUSE WR-19

Same Case Histories as those listed for RCA R-71 receiver

WESTINGHOUSE WR-20

Same Case Histories as those listed for RCA R-74 receiver

WESTINGHOUSE WR-22

Same Case Histories as those listed for RCA R-73 (with '47 tubes) receiver

WESTINGHOUSE WR-23

Same Case Histories as those listed for RCA RE-80 receiver

WESTINGHOUSE WR-24

Noisy reception (especially when walking across floor, or bumping set)	1)	tube socket prongs loose their tension and fail to make good contact with the tube pins. Clean and adjust

WESTINGHOUSE WR-26

Same Case Histories as listed for RCA R-27 receiver

WESTINGHOUSE WR-26M

Same Case Histories as listed for RCA Radiola 17 receiver

WESTINGHOUSE WR-27

Same Case Histories as listed for RCA R-28P (A to G) receivers

WESTINGHOUSE WR-28

Same Case Histories as listed for RCA R-37P receiver

WESTINGHOUSE WR-30

Same Case Histories as listed for RCA 140 and RCA 140E receivers

WESTINGHOUSE WR-31

Same Case Histories as listed for RCA 141 and RCA 141E receivers

WESTINGHOUSE WR-32

Same Case Histories as listed for RCA 100 receiver

WESTINGHOUSE WR-33

Same Case Histories as listed for RCA M-34 receiver

WESTINGHOUSE WR-35

Same Case Histories as listed for RCA 111 receiver

WESTINGHOUSE WR-36

Same Case Histories as listed for RCA 120 receiver

WESTINGHOUSE WR-37

Same Case Histories as listed for RCA 121 receiver

WESTINGHOUSE WR-45

Same Case Histories as listed for RCA 143 receiver

WESTINGHOUSE WR-46

Same Case Histories as listed for RCA 128 receiver

WESTINGHOUSE WR-48

Same Case Histories as listed for RCA 118 receiver

WESTINGHOUSE WR-71

Volume control replacement	1)	if volume control is faulty, replace with a 50,000-ohm wire-wound unit for the screen circuit, and a 50,000-ohm fixed unit in the antenna circuit

WESTINGHOUSE WR-90

Intermittent reception	1)	intermittent short-circuiting to chassis of 0.04-mfd. condenser connected across the first filter choke to tune it. Remove this condenser
Hum	1)	change in capacity of the 0.04-mfd. tuning condenser connected across the choke. Replace with new unit
Fading about 15 or 20 minutes after normal operation	1)	intermittently open-circuiting volume control resistance strip. Replace with a new 500-ohm wire-wound unit

WESTINGHOUSE WR-116

Distortion	1)	electrical "leakage" through cardboard container of filter condenser. Insulate condenser from chassis, or replace

WESTINGHOUSE WR-166

Pilot light bulbs burn out frequently	1)	"open" pilot light shunt resistor. Replace with 35-ohm 2-watt unit

WESTINGHOUSE WR-166L

Rattling (especially on loud notes)	1)	inspect for "loose" rim mounting. Cement in place
	2)	loose voice coil dust cover. Cement in place

WESTINGHOUSE WR-168B

Inoperative (only strong, steady hum heard)	1)	"short" between primary and secondary windings of last i-f transformer. Replace

WESTINGHOUSE WR-173L, 186

Inoperative, Intermittent reception	1)	resolder all terminals of oscillator coil
	2)	"open" osc. coil winding

WESTINGHOUSE WR-186

Inoperative, Intermittent reception	1)	resolder all terminals

WESTINGHOUSE WR-203

Inoperative	1)	"shorted" 0.1-mfd. 400-volt tubular condenser by-passing 6A8 and 6K7 i-f stage plate supply. Use 600-volt replacement
Code interference	1)	set i-f to 450 kc, and carefully adjust wavetrap for minimum code interference . Re-align all circuits If an antenna coupling transformer is used, bolt directly to chassis and run wires to set from it as short as possible. Run 6A8 grid lead down along condenser gang as close as possible

WESTINGHOUSE WR-272

Intermittent reception	1)	resolder all terminals of 2nd i-f transf.
	2)	loose leads on 0.0056-mfd. condenser in oscillator circuit
	3)	faulty trimmer condensers

WESTINGHOUSE WR-303

Same Case Histories as those listed for Westinghouse 203 receiver

WESTINGHOUSE WR-306

Inoperative, Distorted, high-pitched tone	1)	"open" primary in 1st a-f transformer

WESTINGHOUSE WR-310

Modulation hum	1)	"open" line by-pass condenser
	2)	reduced capacity of input filter condenser

WESTINGHOUSE WR-315

Noisy reception	1)	faulty 95-ohm choke under i-f transf. located between 6A8 sockets. Replace with 750-ohm resistor if replacement choke is not readily available

WESTINGHOUSE WR-342

Faulty electric tuning operation
1) check to see if chassis projects too far forward toward front of cabinet. If so, shift it back
2) check small pulley on motor shaft and make sure it is tight and free from end-play
3) inspect dial drive cable. See that it is still on the pulley, and is operated by the lever arm and controlled by the front panel knob designated as "manual-electric"

WESTINGHOUSE WR-366

See also Case History listed for Westinghouse WR-368 receiver

Weak reception at low end of dial
1) "open" coil in plate circuit of 6K7 r-f tube

Dial pointer rocks excessively when automatic tuning is used
1) remove seal on flywheel mounted on motor shaft, and tighten screw located under seal. Reseal with cement
2) clean selector contacts at rear of tuning gang with carbon tetrachloride

WESTINGHOUSE WR-368

Noisy reception
1) replace 6Q7G "muting" tube
2) faulty tapped (2-meg. total) voltage-divider resistor in "muting" circuit. Check

WESTINGHOUSE WR-373Y

Weak reception
1) "short" between 12SK7 grid connection and jumper connecting suppressor and cathode

WESTINGHOUSE WR-473

Phono pickup inoperative
1) inspect for loose i-f transformer "shorting" phono pickup input wires underneath chassis. Mount i-f transformer more securely

WESTINGHOUSE WR-480

Inoperative
1) "shorted" 8-mfd. input filter condenser. Replace with 450-volt unit

WESTINGHOUSE WR-679

Weak reception
1) inspect loop antenna for broken connection

Whistling or squealing
1) no shield, or loose shield, on 1A7GT mixer

Howling
1) microphonic 1H5GT tube. Try several new tubes

WESTINGHOUSE *(CANADIAN)*

(The Case Histories of WESTINGHOUSE *(AMERICAN)* receivers are listed on pages immediately ahead of this one)

See also the WESTINGHOUSE receiver Model-Number Cross-Indexes in *Sections 5 and 6* of this *Handbook.*

WESTINGHOUSE *(CANADIAN)* 6 a-c 1927/28

Same Case Histories as listed for RCA Radiola 17 receiver

WESTINGHOUSE *(CANADIAN)* 6 a-c 1928/29

Same Case Histories as listed for RCA Radiola 18 and RCA Radiola 33 receiver

WESTINGHOUSE *(CANADIAN)* W-16

Same Case Histories as listed for RCA Radiola 16 receiver

WESTINGHOUSE *(CANADIAN)* A-43

Same Case Histories as listed for RCA M-34 receiver

WESTINGHOUSE *(CANADIAN)* W-44

Same Case Histories as listed for RCA 100 and RCA M-101 receivers

WESTINGHOUSE *(CANADIAN)* A-53

Same Case Histories as listed for RCA 110, 111 and 115 receivers

WESTINGHOUSE *(CANADIAN)* W-53

Same Case Histories as listed for RCA R-28, R-28P, R-28P (A to G), 110, 111, 115 and 120 receivers

WESTINGHOUSE *(CANADIAN)* W-54 (A, B, C or D)

No AVC action when frequency-range switch is in "short-wave" position
1) on early-production receivers, this AVC action may be obtained on short-wave reception by adding a 0.025-mfd. 200-volt condenser in series with the tap on the antenna coil secondary. A similar condenser should be added in series with the tap on the osc-det. tuning coil

WESTINGHOUSE *(CANADIAN)* W-61

See also Case Histories listed for RCA Radiola 47 and Radiola 48 receivers

Inoperative (negative potential on the plate of the detector tube)
1) short-circuited 2-mfd. filter condenser between the center-tap of the filter choke and terminal *No. 6*

Hum
1) in early-run receivers, add a 1-mfd. 800-volt condenser across the original 0.1-mfd. first filter condenser in the power unit

WESTINGHOUSE *(CANADIAN)* W-64

Same Case Histories as listed for RCA 121 receiver

WESTINGHOUSE *(CANADIAN)* W-71

Same Case Histories as listed for RCA Radiola 42 and Radiola 48 receivers

WESTINGHOUSE *(CANADIAN)* W-73

Same Case Histories as listed for RCA 330 receiver

WESTINGHOUSE *(CANADIAN)* W-80

Inoperative (no voltage on '24 or '27 tubes, and high plate voltage on 45's)
1) "open' voltage divider

(Cont'd over)

WESTINGHOUSE *(CANADIAN)* W80—*(Cont'd)*

Weak reception (low plate voltage on r-f tubes)	1)	"shorted" r-f plate by-pass condenser
Noisy reception (all stations)	1)	faulty detector plate choke or audio input transformer
Hum (otherwise O.K.)	1)	"shorted" 0.3-mfd. condenser *C-19* across filter reactor

WESTINGHOUSE *(CANADIAN)* W-81

Same Case Histories as listed for RCA Radiola 42 and Radiola 48 receivers

WESTINGHOUSE *(CANADIAN)* W-82

Same Case Histories as listed for RCA R-71 and R-72 receivers

WESTINGHOUSE *(CANADIAN)* W-83AW

Same Case Histories as listed for RCA 140, 140E, 141, 141E receivers

WESTINGHOUSE *(CANADIAN)* W-84

Same Case Histories as listed for RCA 143 and 242 receivers

WESTINGHOUSE *(CANADIAN)* W-89

Same Case Histories as listed for RCA Radiola 66 receiver

WESTINGHOUSE *(CANADIAN)* W-90, W-99, W-99A

Inoperative (except at one critical spot on volume control)	1)	"open" volume control resistor strip
Whistling or squealing (over entire tuning range)	1)	re-neutralize, or replace, i-f transformers
Whistling or squealing (at high-frequency end of scale)	1)	unscrew r-f compensators slightly
Whistling or squealing (on some stations, and not on others)	1)	image-frequency interference due to r-f stages being out of balance
Noisy reception, Intermittent operation	1)	loose or oxidized socket contacts
Hum (in console sets)	1)	if hum disappears when cone is held, check for off-center cone

WESTINGHOUSE *(CANADIAN)* W-101

Same Case Histories as listed for RCA Radiola 80 receiver

WESTINGHOUSE *(CANADIAN)* W-102

Same Case Histories as listed for RCA R-9, R-74 and R-76 receivers

WESTINGHOUSE *(CANADIAN)* W-103

See also Case Histories listed for RCA R-90 receiver

Weak signals, Fading, Broad tuning, Indistinct tuning-light operation	1)	follow manufacturer's instructions for adjusting the i-f circuits of the receiver to *exactly* the frequency at which the untuned transformer is "peaked" (around 175 kc)—i.e., so the AVC circuit and the signal circuit are in synchronism

WESTINGHOUSE *(CANADIAN)* W-104

See also Case Histories listed for RCA R-90P receiver

Weak signals, Fading, Broad tuning, Indistinct tuning-light operation	1)	follow manufacturer's instructions for adjusting the i-f circuits of the receiver to *exactly* the frequency at which the untuned transformer is "peaked" around 370 kc)—i.e., so that AVC circuit and the signal circuit are in synchronism

WESTINGHOUSE *(CANADIAN)* W-110

Inoperative (except at one critical spot on volume control)	1)	"open" volume control resistor strip
Whistling or squealing (over entire tuning range)	1)	re-neutralize, or replace, i-f transformers
Whistling or squealing (at high-frequency end of scale)	1)	unscrew r-f compensators slightly
Whistling or squealing (on some stations and not on others)	1)	image-frequency interference due to r-f stages being out of balance
Noisy reception, Intermittent operation	1)	loose or oxidized socket contacts
Hum (in console sets)	1)	if hum disappears when cone is held, check for off-center cone

WESTINGHOUSE *(CANADIAN)* W-112

Same Case Histories as listed for RCA RO-23 receiver

WESTINGHOUSE *(CANADIAN)* W-120

Inoperative (except at one critical spot on volume control)	1)	"open" volume control resistor strip
Whistling or squealing (over entire range)	1)	re-neutralize, or replace, i-f transformers
Whistling or squealing (at high-frequency end of scale)	1)	unscrew r-f compensators slightly
Whistling or squealing (on some stations and not on others)	1)	image-frequency interference due to r-f stages being out of balance

(Cont'd)

WESTINGHOUSE *(CANADIAN)* W-120—*(Cont'd)*

Noisy reception, Intermittent operation	1)	loose or oxidized socket contacts
Hum (in console sets)	1)	if hum disappears when cone is held, check for off-center cone

WESTINGHOUSE *(CANADIAN)* W-122, W-122A

See also Case Histories listed for RCA R-78 and R-78 (2) receivers

Weak signals, Fading, Broad tuning, Indistinct tuning-light operation	1)	follow manufacturer's instructions for adjusting the i-f circuits of the receiver to *exactly* the frequency at which the untuned transformer is "peaked" (around 175 kc)—i.e., so the AVC circuit and the signal circuit are in synchronism

WESTINGHOUSE *(CANADIAN)* W-124

Same Case Histories as listed for RCA 281 receiver

WESTINGHOUSE *(CANADIAN)* W-155

Same Case Histories as listed for RCA 118 and 211 receivers

WESTINGHOUSE *(CANADIAN)* W-165A

Same Case Histories as listed for RCA 128 receiver

WESTINGHOUSE *(CANADIAN)* W-165X

Same Case Histories as listed for RCA 224 receiver

WESTINGHOUSE *(CANADIAN)* W-175A, W-175X, W-175Y

See also Case Histories listed for Westinghouse (*Canadian*) W-225A receiver

Tuning indicator does not operate, but reception is normal	1)	check small 1-megohm resistor *R-11* in the 6E5 tube socket

WESTINGHOUSE *(CANADIAN)* W-185X

Same Case Histories as listed for RCA 143 receiver

WESTINGHOUSE *(CANADIAN)* W-195X, W-195Y

Same Case Histories as listed for Westinghouse (*Canadian*) W-175A and W-255A receivers

WESTINGHOUSE *(CANADIAN)* W-254

Same Case Histories as listed for RCA 118 and 211 receivers

WESTINGHOUSE *(CANADIAN)* W-255A, W-255X, W-255Y, W-255Z

Tuning dial control-shaft turns but gang condenser does not move at once	1)	first planetary reduction in the base of the tuning condenser drive assembly not functioning properly. May be due to a broken or cracked main control shaft that should be replaced . If shaft is broken, be sure to remove broken end before installing new one
	2)	weak tension being exerted by coiled spring inside of drive assembly. Increase tension
Tuning dial control-shaft revolves but gang condenser does not turn smoothly	1)	friction in gang condenser bearings. Lubricate condenser bearings sparingly with Castordag and, if necessary, slightly slacken thrust screw at the rear end of condenser shaft
	2)	cracked spring washers which press two large main drive balls against lower edge of main drive disk (behind dial). Install two new spring washers

WESTINGHOUSE *(CANADIAN)* W-275A, W-275X, W-275Y

Same Case Histories as listed for Westinghouse (*Canadian*) W-225A receiver

WESTINGHOUSE *(CANADIAN)* W-295X, W-295Y

Same Case Histories as listed for Westinghouse (*Canadian*) W-175A and W-255A receivers

WESTINGHOUSE *(CANADIAN)* B-365A, B-365X

To improve the audio output on early-run receivers	1)	increase resistor *R-14* in the output tube plate circuit to 30,000-ohms

WESTINGHOUSE *(CANADIAN)* W-410

Modulation hum	1)	connect two 0.05-mfd. 400-volt condensers in series across the power transformer primary, grounding the center junction to the receiver chassis

WESTINGHOUSE *(CANADIAN)* W-465A, W-465X

Same Case Histories as listed for Westinghouse (*Canadian*) W-225A receiver

WESTINGHOUSE *(CANADIAN)* B-466, B-470, B-470A

Frequent tube failure	1)	cut *positive* lead (external to chassis) to A battery plug and solder a 0.5-ohm resistor (Part *No. H-40446*) in series with it

WESTINGHOUSE *(CANADIAN)* W-534

No AVC action when frequency-range switch is in "short-wave" position	1)	on early-production receivers, this AVC action may be obtained on short-wave reception by adding a 0.025-mfd., 200-volt condenser in series with the tap on the antenna coil secondary. A similar condenser should be added in series with the tap on the osc.-det. tuning coil

WESTINGHOUSE *(CANADIAN)* W-555A (Serial No. below *A-56398*), W-555B (Serial No. below *A-47847*), W-555 (Serial No. below *A-79048*), W-555AAA (Serial No. below *A-86298*), W-555BB (Serial No. below *A-88298*)

Whistling or squealing when antenna lead is not unfolded from spool	1)	change 68-mmfd. condenser *C-2* to 82-mmfd.
Improving reception	1)	replace present oscillator coil with new type No. 587304-502 coil having an extra winding to supply coupling instead of 68-mmfd. condenser *C-6*. Wire this part of circuit up similarly to that in Model W-556A
To increase power output from ¾-watt to 1¼-watt	1)	change 220,000-ohm resistor *R-9* to 470,000 ohms

WESTINGHOUSE *(CANADIAN)* 556-A (Serial No. below *A-58399*)

Whistling or squealing	1)	change condenser *C-4* to a 0.2-mfd. 250-volt unit
To provide increased output	1)	change resistor *R-8* to a 470,000-ohm unit

WESTINGHOUSE *(CANADIAN)* 560-A, 560-B

Whistling when a station is tuned in	1)	add a 0.1-mfd. 400-volt paper tubular condenser in parallel with 10-mfd. filter condenser section *C-22*, i.e., from B+ to ground

WESTINGHOUSE *(CANADIAN)* B-562A (Serial No. below *A-27197*)

To improve performance of receiver	1)	change 4.7-mmfd. condenser *C-6* to 8.2-mmfd. Change 12.0-mmfd. condenser *C-7* to 8.2-mmfd.. Remove 0.01-mfd. 400-volt condenser *C-4* from circuit
		Locate grounded end of winding in coil L-14. Connect it to the common junction of resistors *R-6* and *R-7* instead of to ground

WESTINGHOUSE *(CANADIAN)* W-565X

Same Case Histories as listed for Westinghouse (*Canadian*) W-255A receiver

WESTINGHOUSE *(CANADIAN)* B-634

Same Case Histories as listed for RCA 223 receiver

WESTINGHOUSE *(CANADIAN)* W-634

Same Case Histories as listed for RCA 121 receiver

WESTINGHOUSE *(CANADIAN)* W-651A, W-651X, W-651Y (Serial No. below *A-25697*)

Whistling or squealing	1)	connect a 39,000-ohm resistor in series with "high" end of volume control and *common* connection of 2nd i-f secondary (*L-12*) and resistor *R-4*. Condenser *C-14* is left connected to "high" end of control

WESTINGHOUSE *(CANADIAN)* 683-A

Oscillation when operating from antenna at full volume	1)	connect a 100-mmfd. moulded condenser between "high" side of volume control and the chassis ground

WESTINGHOUSE *(CANADIAN)* 684-

To set up pushbuttons for improved stability of adjustment	1)	reverse the usual order of adjustment, that is, use the left hand button for the station of *highest* frequency and the remaining buttons to cover the other stations being set up in reverse order of frequency

WESTINGHOUSE *(CANADIAN)* B-742, B-743

To increase receiver sensitivity greatly	1)	solder a 33,000-ohm ½-watt carbon resistor in parallel with present 27,000-ohm resistor now in screen voltage supply circuit to W-1D7-G converter and W-1D5-G r-f amplifier tubes

WESTINGHOUSE *(CANADIAN)* 780-X

"Rasping" effect at high volume	1)	reconnect the 100-mmfd. condenser *C-29* so it is connected from the 6F6G control-grid to ground
Double peak tuning, Excessive sideband noise when tuning	1)	connect a 33,000-ohm ½-watt carbon resistor *in series* with the lead from low end of second i-f transf. secondary *L-23* to phono switch S-5

WESTINGHOUSE *(CANADIAN)* 785

Same Case History as listed for Westinghouse (*Canadian*) 684 receiver

WESTINGHOUSE *(CANADIAN)* W-801

Same Case Histories as listed for RCA 7, 7A and 9 receivers

WESTINGHOUSE *(CANADIAN)* W-837, W-1038 and W-1239— (Electric Tuning Mechanism)

Grinding noise in both directions	1)	gears not meshing properly. Adjust gear-mesh studs, which are mounted eccentric to the gear shaft. Rotation of the stud changes the gear position
Rattling noise	1)	small pinion not in line with motor shaft, or small pinion boss is loose
Grinding noise and vibration in one direction	1)	loose motor bearing, rotor touching field
Motor stronger in one direction	1)	rotor is not centered between field poles, and is too close at one point. Loosen brass brackets and change position
Motor and flywheel performance irregular	1)	dirt or metal filings under friction leather, or rotor off-center as above. Remove set-screws and springs and clean friction leather. (Apply neatsfoot oil if available)
Motor will not disengage readily	1)	friction due to bearings being out of line, or phosphor bronze spring too strong
60 cycle motor over-travels considerably, hesitates, comes back, oscillates	1)	flywheel tight. Loosen set-screws slightly
25 cycle motor has slow oscillation, flywheel reverses with motor	1)	tight flywheel. Loosen set-screws slightly
Motor has rapid oscillation	1)	loose flywheel. Tighten flywheel. If this does not work, examine friction leather for dirt
Motor chatters when starting, or will not pull-in	1)	poor pull-in torque due to weak electrolytic condenser or weak phosphor bronze spring. Check spring on 25 or 60 cycle; check 60-mfd. electrolytic condenser on 60 cycles (across motor windings)
Oscillation on certain buttons only	1)	check contact tip of selector assembly for loose fit in body. See that nose of contact is not burned nor distorted out of correct shape
	2)	clean the insulating gap of selector disc, being sure to remove all metal particles and metallic fragments from bevelled edges of the brass. Each contact should be checked to assure that clearance exists (appx. .010") between it and the disc when stopped in position on the station
	3)	inspect the insulating gap to see that it has not changed shape due to bending or warping. Replace the disc if cleaning and adjustment fail to give correct operation
Adjustment of phosphor bronze springs	1)	on cabinets where the chassis slopes backward, a phosphor bronze spring is used to assist the solenoid action of the motor. A light spring is used in 837-Y, 1038-Y, 1239-X cabinets, a heavier one in 837-X and 1038-X. This spring should be adjusted by bending until it bears lightly on the end of the motor shaft when the motor clutch is fully engaged. Too loose an adjustment will result in rattle of the spring and failure of the motor to pull-in, whereas too tight a spring will prevent the motor from disengaging promptly, causing it to oscillate

WESTONE

WESTONE 20

Inoperative on broadcast band — 1) single bolt holding chassis to cabinet touching contacts on short-wave switch, causing broadcast sections of both r-f coils to ground to chassis. Tape bolt or put fibre bushing around it

WHOLESALE RADIO SERVICE, INC.

(See Case History listings under LAFAYETTE receivers)

WILCOX-GAY

WILCOX-GAY "DUAL-SPEED" Phono-Radio Models

To increase low-frequency response on records (in Models with Serial numbers under *621520*) — 1) remove 500,000-ohm resistor shunted directly across crystal pickup, and replace it with a 1 or 2-megohm resistor. The higher value will provide greater low-frequency response

WILCOX-GAY 50A

Rattling, Distortion — 1) clean out air gap between voice coil and pole piece of speaker. To prevent future trouble from dirt settling in this space, remove the speaker and cut a piece of thin soft felt or soft leather slightly larger than the diameter of the voice coil. Glue it over the voice coil opening

WILCOX-GAY "Recordio" A-72

Indicator eye tube (6U5) flickers, and motorboating sound is heard on the "playback" of recordings when vol. control is turned up and selector switch is in the "cut" position — 1) due to audio oscillations caused by the coupling in the common plate and screen 50,000-ohm resistor. Disconnect the "high" end of the 500,000-ohm 6J7 screen resistor *R-3* from the hum filter composed of *C-3* and *R-5*, and connect it directly to B+ instead

WILCOX-GAY A-89, A-91, A-92

To increase low-frequency response on records (in Models with Serial numbers under *621520*) — 1) remove 500,000-ohm resistor shunted directly across crystal pickup, and replace it with a 1 or 2-megohm resistor. The higher value will provide greater low-frequency response

Hum (in Models bearing serial numbers below *No. 624060*) — 1) disconnect the spiral shield covering of the volume control leads, from the volume control terminal and solder the shielding directly to the volume control switch cover.

Remove the wire placed through the rubber grommet in the vertical shield fin, which connects the ground terminal of the volume control to chassis.

Run a wire from the ground terminal of the volume control through the fibre grommet in the chassis base directly below the volume control, to the ground lug located near the electrolytic condenser in the approximate center of the underside of the chassis. (Note: *R-33* and *C-33* are already connected to this lug.) Do not permit the volume control ground terminal to contact the chassis through any other medium.

Move the ground connection of the 6Q7 cathode by-pass condenser, *C-18* from its present location on the assembly lug of the electrolytic condenser, to the chassis ground lug to which the volume control has been grounded.

WILCOX-GAY A-93, A-94

See also Case Histories listed for Wilcox-Gay A-89 receiver

"Wow" recorded in records (in equipment bearing Serial No. below *624010*) — 1) increase tension of intermediate drive wheel spring by following procedure:

a) Remove turntable and intermediate drive wheel assembly.

b) Remove recorder-changer unit by removing the four mounting screws, and disconnecting cables with plugs, from Recordio chassis.

c) Place recorder-changer unit on the work bench, tilted to a position that provides easy access to the under side of the unit. Do not place unit in an upside-down position, as the record spindle may be sprung or bent.

d) Remove the intermediate drive wheel spring, and make alterations to the spring in accord with the specifications given below.

e) Remove twelve turns at the hook end of the spring. Straighten out three turns of the coiled spring, and—form a new hook so that the bend in the hook is only ⅛" from the coiled spring. Do not make a sharp bend in forming the hook. Instead, form a 1/16" radius as shown in the drawing.

f) Before replacing the spring in the unit, remove the burred or ragged edge of the hole in the base plate, through which the pin protrudes for attachment of the loop end of the spring.

g) After the spring has been installed, and the unit restored to the cabinet, the intermediate drive wheel assembly and turntable should be replaced.

"Wow" in the order of four times per turntable revolution — 1) defect in rubber-rimmed drive wheel. May be out of round, warped, or may have flat spot or bump on rubber rim

"Wow" once per turntable revolution — 1) some dent or irregularity in rim of turntable. Running finger tips lightly over inside surface of turntable rim will show up any irregularity sufficiently pronounced to produce "wow"

2) badly warped record

WILCOX-GAY A-101

Hum — 1) see remedy for this Trouble Symptom listed under Wilcox-Gay A-89

WILCOX-GAY A-105, A-111, A-112, A-113, A-113B, A-114, A-115, A-115B

Fails to trip at end of record — 1) make sure that record has eccentric groove at inside

2) lack of proper contact or friction of the leather finger on the trip switch with the knurled surface on the rocker plate. Too great an opening of the contact points will not allow the switch to close during an oscillating action. Check and set points for 0.020" gap when trip switch is at rest (leather finger not in contact with rocker plate). The switch can be removed by taking out the two lockwasher screws in the slotted section immediately below the clamp holding the one *red* and two *black* wires. After the contact point clearance has been set and checked, the switch should be replaced and set to the point where the leather finger just makes contact with the rocker plate. A forward and back motion of the rocker plate should move the phosphor bronze spring slightly. The phosphor bronze support spring eliminates the fatiguing of the leather finger to a semi-circular position and gives constant upward pressure on the leather finger. The trip switch should not be set too high whereby the leather and phosphor bronze spring both engage the rocker plate

(Cont'd over)

WILCOX-GAY A-105, A-111, A-112, A-113, A-113B, A-114, A-115, A-115B—*(Cont'd)*

Fails to trip at end of record —(*Cont'd*)

When trip switch is correctly positioned, the switch contacts will remain normally open at all times excepting after the playback arm reaches a position near the center of the turntable. A slight reversal in the lateral movement of the arm will cause the contacts to close The contact spacing should be approximately 0.020" and the leather piece should just touch the stop bracket when the switch is "idle" or "at rest"

(*a*) position the switch so that the leather finger just touches the rocker plate surface, and note the point of contact between the leather and the phosphor bronze spring

(*b*) raise the switch vertically (toward the rocker plate) until the end of the phosphor bronze spring nearly touches the rocker plate

(*c*) the correct switch position will be found to be approximately half way between these two extreme positions

Mechanism trips but pickup arm does not return to record

1) this is usually caused by failure of the lock-in switch to open when the cam assembly is at the end of its forward motion. The lock-in switch should have a clearance of approximately 0.025" and can be adjusted by bending forward or backward arm "X". Bending the arm so that more pressure is exerted on the fiber stub of the long contact arm *increases* the gap, and bending the arm so that less pressure is exerted *decreases* the gap contact. Failure of the arm to return to the record is sometimes caused by binding action of the reset pin and rocker plate, or failure of the reset pin to engage the rocker plate

Pickup arm does not drop at proper point on record

1) the pickup arm when returning to the record should drop at a point half-way between the first playing groove and the edge of the record. The kick-in spring moves the pickup arm gently to the first playing groove. If the needle is dropping into the first playing groove, then loosen the screw in front of the pickup arm bracket and immediately under the pickup arm channel. Move the pickup arm bracket slightly outward and tighten the screw. If the arm is droping at the edge of the record, loosen the screw and move the pickup arm bracket slightly inward and retighten screw

Pickup arm remains stationary at about the center of home recorded discs

1) make sure first that the home recorded disc has a good clean groove and the proper depth of cut. Pivot posts of the pickup arm should be set to the point where very little play is evidenced, but not to the "binding" point. The lower part of the pickup arm channel should just come flush with or a little bit lower than the top of the turntable. If the arm is above the turntable, the flat bracket immediately above the push rod in the center of the pickup arm shaft should be bent upward slightly. Positioning of the trip switch to the point where the leather finger engages the rocker arm too high sometimes causes friction which will hold the pickup arm in place when home recorded records are played. Be sure that the pickup arm cord is hanging free and is not under pickup arm bracket and arm channel

(Cont'd)

WILCOX-GAY A-105, A-111, A-112, A-113, A-113B, A-114, A-115, A-115B—*(Cont'd)*

Record changing process erratic and fast

1) dash pot has lost its snubbing action. The dash pot, which is an air chamber with an internal spring return piston and air air release serves to govern the speed at which the main cam or changing process operates. At the start of the solenoid stroke, the contacts on the lock-in switch, which is connected in parallel with the trip switch, are closed maintaining energy in the solenoid. The draw spring then functions to pull the main cam assembly forward against the snubbing action of the dash pot. At the end of the stroke, when the lock-in switch points are opened, energy is released from the solenoid and the internal spring of the dash pot returns the main cam assembly to tis original position. Always replace a defective dash pot, and *never attempt to repair or oil the plunger.* The manufacturer reports that this plunger is treated by a special process and further oiling will eventually ruin the leather

Buzzing or weak solenoids in record changer

1) incorrect spacing of the lock-in switch oftentimes cause the solenoid to buzz or chatter during the change period. If the contacts are set so that they are just touching on the solenoid stroke, vibration will cause them to open and close resulting in the solenoid being energized and de-energized at a very rapid rate. If the lock-in switch contacts are correctly set and buzzing still continues, it is usually found to be in the laminations of the solenoid and the only cure is replacement of the complete solenoid including core. The solenoid plus the core are matched at the factory and the complete assembly should be installed

2) the solenoid on the Insta-Matic changer used in these models is designed to operate satisfactorily on line voltage of 105 volts or above. Lower line voltages will cause the mechanism to either chatter or buzz, and in some cases it will not operate. If the line voltage is above 105 volts and the mechanism changes very slowly or the solenoid plunger is drawn only partway in, this is an indication of a weak solenoid and the only solution is to install a new assembly. This naturally is assuming that all other adjustments, such as the dash pot, reset plate and rocker arm, are correct

---

WINCHARGER

"WINCHARGERS"

"Wincharger" does not charge at all

1) check the position of the third brush, which often moves out of its correct position. The correct position is one segment of the commutator away from the nearest brush. On the later models this trouble can be corrected while the head is still mounted

Charging rate cannot be increased above 3 or 4 amperes

1) check lugs on collector arm leads for good contact. In many cases these lugs will be found "crimped" on to the wire lead instead of being soldered. Solder all these connections

---

WINGS

(See Case History listings under BELMONT)

WURLITZER

(In addition to Case Histories listed here, see listings under LYRIC)

WURLITZER Superhets

See also Case Histories listed under Lyric

Noisy	1)	i-f coils wound with 6-strand litz wire. Failure of one strand won't show up on ohmmeter but increases r-f resistance of the coil. Cut leads, fray and scrape each strand separately and resolder

WURLITZER 24

Inoperative	1)	if 5Z3 rectifier tests "dead," check for "shorted" 350-mmfd. condenser connected to the 6L6 plates in the output stage

WURLITZER SA-120

Inoperative, Weak reception, Motorboating sound (when inter-station silencer is turned to extreme left)	1)	check three 5-mfd. 50-volt electrolytic condensers. Replace any faulty units with condensers of higher voltage rating

WURLITZER 312 Automatic Phonograph

Hum	1)	try changing the 1B5/25S tube
	2)	check filter condensers

WURLITZER 450

Inoperative	1)	feel speaker field. If it is hot, check for "short" between primary and secondary windings of first i-f transformer located between two 58 tubes. Short usually occurs between coil leads where they cross

---

ZANEY-GILL

ZANEY-GILL (All Models)

Intermittent reception	1)	loose screws that hold trimmer condensers in place
Whistling or squealing	1)	poor connections at rivets. Solder to chassis all rivets which act as connections for by-pass returns, etc.

ZENITH

ZENITH Phono-Radio Models—(General Servicing Notes)

Low volume	1)	poor contact in phono switch and plug contacts
	2)	check shield on lead from crystal pickup for poor "grounding"
Distortion	1)	cracked or broken crystal in pickup head

ZENITH "Portable" Receivers—(General Servicing Notes)

Inoperative on batteries but O.K. when line-operated	1)	check batteries
	2)	"poor" switch contact at back of plug receptacle on chassis
Inoperative on line, but O.K. on batteries	1)	check 117Z6G tube
	2)	"open" 1-watt series filament resistor next to 117Z6G cathode. Replace with 2-watt unit
Weak reception (all tubes, batteries and parts check O.K.)	1)	weakened permanent magnet in speaker. Replace speaker
	2)	fabric material on loop cable has absorbed moisture, causing electrical leakage

ZENITH "Auto-Radio" Receivers—(General Servicing Notes)

Inoperative	1)	"open" voice coil
Intermittent reception, Noisy	1)	inspect antenna trimmer condenser for fine grains of metal torn from movable plate thread whenever condenser is adjusted. Replace
	2)	bad loktal tube pin connections. Tighten socket prongs

ZENITH 1937 Auto Radio Models (General Servicing Notes)

Intermittent reception, Squealing, Fading	1)	loosened rivets on r-f coil shields. Remove bottom cover and bond all coil shields together and to chassis base
	2)	locate all places where a soldering lug is fastened to chassis with a machine screw. Solder these lugs directly to chassis

ZENITH 1937 Home Radios (General Servicing Notes)

Weak reception (tuning eye cannot be centered)	1)	replace both i-f coils if i-f coil form is hollow *paper* type
Weak reception, Broad tuning (in 6 and 8 tube models)	1)	increased resistance in primary windings of i-f transformers. Resistance varies from the normal 6 ohms to as high as 90 or 3000 ohms. Replace all i-f transformers for permanent repair
Difficulty in getting "peak" tracking on all bands (in 8, 10 and 12 tube models)	1)	fault lies in the shifting of the inductance in the tapped first detector coil. The consequent mismatching of the inductive-capacitive design results in the shifting of the peak resonant condition for optimum alignment of the circuit. In other words, due to the poor matching of inductances as a result of this shift, a resonance peak cannot be obtained in the r-f tuned circuits The remedy for this is to shift the small fixed 5-mmfd. mica condenser (*C-1*) ordinarily connected in the grid circuit of the antenna coil secondary, over to the first detector coil circuit in the identical position. When this is done, matching of the coils becomes closer, and a consequent improvement in sensitivity is obtained
Motorboating sound (with switch in "distance" position)	1)	check screen and by-pass condensers (*C-4*). Replace faulty units

(Cont'd over)

ZENITH 1937 Home Radios—*(Cont'd)*

Scratching noise heard when tuning "spinning flywheel" type models	1)	flywheel not making proper ground at end of shaft. Tighten spring at end of shaft by moving pulley toward center. Lubricate it with a drop of oil
Crackling, frying noises (which persist even after antenna and ground are disconnected)	1)	noisy 1st i-f transformer. This may be checked by connecting a high-resistance voltmeter across the primary winding and observing fluctuations with set operating. When replacing this transformer, be sure that the long plate lead from the 6A8G is as short as possible, and is dressed against the chassis over its whole length. Otherwise circuit oscillation will result
Electric tuning service adjustments	1)	make sure that nothing is obstructing the free action of either the belt, the pulley, or the drive shaft, such as wires or component parts
	2)	check the band change shaft for clearance on the 9-12-15 tube models. The die-cast bracket through which the brass drive shaft for the motor travels can be centered properly by loosening the two Parker-Kalon screws which hold the bracket to the front of the dial assembly. After centering this die-cast bracket retighten the two Parker-Kalon screws
	3)	check the 9/16-inch nut at the rear of chassis in this manner; loosen the nut, permit the motor to run and retighten the 9/16-inch nut while in operation. This will allow the front and rear bearings to align themselves properly
	4)	check for ample clearance between the dial gang drive pulley and the mounting nut for the bearing through the front of the chassis approximately 1/32-inch clearance. Brass drive shaft should also have ample clearance at rear of chassis between collar mounted on motor switch
	5)	the large drive pulley mounted on the rear of the brass shaft should be in line with the small pulley which will be found mounted on the motor armature. Alignment can be accomplished by loosening the two set-screws and sliding the large pulley either backward or forward on the brass shaft
	6)	the tension of the drive belt for the motor can be adjusted by loosening the two hexagon bolts found at the rear of the chassis and holding the motor assembly. The motor assembly should be moved in the elongated holes until the drive belt has a snug tension but not too tight an action. Then retighten the hexagonal mounting bolts
	7)	if the drive mechanism has a tendency to slip when using the large manual knob, check for a loose spring clutch. All adjustments to the clutch should be made very carefully. Adjustments are made by turning the screw mounted through the blue steel clutch spring found at the front of the brass drive shaft mechanism. By running the screw in, the action will be tightened, and by running the screw out, the action will be loosened, but in all cases only one or two complete turns should be necessary
	8)	all bearings, dial mechanism and gears of the gang should be lubricated approximately once a year. If at any time it is necessary to change the electric eye tube, care should be taken not to place the tube too far forward, as this will cause a strain to be placed on the dial pan (causing friction at the center hub of the gang shaft) and the motor assembly will not operate freely

(Cont'd)

ZENITH 1937 Home Radios—*(Cont'd)*

Electric tuning service adjustments —*(Cont'd)*		

ZENITH 1938 Home Radios—(General Servicing Notes)

Inoperative below 1200 kc (common in 5 Tube A-C Models)	1)	"open" oscill. coil primary. Shunt this "open" primary with a 10,000-ohm resistor
Inoperative, completely of band (home battery receivers) or over part	1)	if receiver employs a 1A6 or 1C6 pentagrid converter tube, reduce screen voltage (of this tube only) by connecting a 50,000-ohm resistor in series with screen. By-pass this to ground with a 0.1-mfd. condenser
Distortion at low volume (15-Tube Models)	1)	connect a 0.0005-mfd. condenser in series with a 150,000-ohm resistor and connect this combination from the first audio tube grid to ground
Noisy tuning on short-wave bands	1)	remove condenser and switch shaft and clean with Carbon Tetrachloride. Also clean shaft bearing

ZENITH 1940 Home Radios—(General Servicing Notes)

Push-button inoperative	1)	if push-button does not push switch in far enough, bend switch arm so there will be more leverage
"Noisy" operation of automatic tuning	1)	dress leads to automatic tuning assembly *away* from metal frame of assembly
"Noisy" when receiver is jarred	1)	*orange* colored resistor on loop loading coil "grounding" against chassis
	2)	broken or loose leads in 6U5 socket
	3)	*black* wire on S.W. antenna coil not grounded properly to aeroplane terminal
	4)	"noisy" Wavemagnet loop antenna due to rubber insulation of loop lead touching trimmer lug, antenna terminal, or other end of loop winding
	5)	"poor" connection to loop shields
Distortion (in Bakelite-encased Models)	1)	dress leads from tone-control condenser and switch *away* from 6Q7 tube
Weak radio reception in phono Models	1)	check phono switch and plug contacts
Weak phono	1)	check shield on lead from crystal for poor grounding

ZENITH 1941 Home Radios—(General Servicing Notes)

Weak reception	1)	the primary winding of the Wavemagnets used on 1941 models is of the high impedance type and the natural period of this winding is within the broadcast band. When an antenna is connected to the primary winding the additional capacity tunes it below broadcast frequen-

(Cont'd)

ZENITH 1941 Home Radios—(General Servicing Notes) —(*Cont'd*)

Weak reception		cies which is very desirable for energy transfer. However, this requires that the primary winding be short circuited whenever an external antenna is *not* attached in order to preserve the tuning characteristics of the loop winding. A shorting bar is provided for this purpose, and should *always* be in place when the receiver is operated on the Wavemagnet alone
Weak reception on short-wave	1)	"open" r-f choke in 1232 tube plate circuit
Noisy reception	1) 2) 3)	dial rubbing against escutcheon stator lugs on braid of gang condenser rubbing against side of opening in chassis seat all loktal type tubes firmly in their sockets
Receiver cannot be aligned	1)	check for "open" or rosin connection on primary winding of Wavemagnet
Overloading, Distortion	1)	"open" resistor in first-detector avc circuit
Low volume on phono	1)	check shield on lead from crystal cartridge for poor "grounding"
Distortion on phono	1)	cracked or broken crystal in pickup

ZENITH "Radiorgan"

Noisy when tuning	1) 2) 3)	dirty condenser gang wipers, or plates flywheel touching band switch lug volume control or drive shaft not making good contact to ground
Volume control "peaks" at two positions, and distorts at low volume	1)	isolate 6F5 grid return from i-f plate leads
No control of tone	1)	insulation on 33,000-ohm resistor cut through, "shorting" to cathode lug
Too much tone control on some buttons, none on others	1)	"shorted" tone condenser or switch leads
Tone changes with each different setting of volume control	1) 2) 3)	faulty volume control terminal of tone switch or volume control "shorted" "poor" volume control contacts, or "shorted" taps

ZENITH "Zenette" A, B, C, D

Weak reception	1)	check *green* and *red* leads of coil in antenna circuit. If either one is grounded at its respective coil contact, remove this ground
Poor reception	1) 2)	increase in value of bleeder resistors defective 900-ohm type '45 bias resistor. Replace with a 10-watt unit
Erratic operation, "Squeals"	1) 2)	replace 25,000-ohm series plate resistor with same unit in 10-watt size check all high value resistors in detector plate circuit for 25% change in value, also 1-megohm resistor in first r-f grid-return circuit. If defective, replace

(Cont'd)

ZENITH "Zenette" A, B, C, D—(*Cont'd*)

Erratic operation, "Squeals" —(*Cont'd*)	3) 4)	connect 0.00025-mfd. condenser from detector choke to ground in radio-phono combinations, keep wire from phono switch as far away from receiver circuits as possible
Intermittent hum	1)	replace filter condensers

ZENITH CH Series

Intermittent reception (tubes and voltages check O.K.) (normal operation restored when oscillator tube is tapped)	1)	defective oscillator tube. Replace with new tube
Weak reception, Whistling or squealing	1)	defective 0.5-mfd. condenser connected from the ground to the cathode of the second detector tube (even though it may test O.K.). Replace with new unit
No control of volume, Excessive regeneration	1)	defective electrolytic condenser located in square can at far end of chassis, which by-passes choke located underneath the chassis
Loss of volume when volume control is advanced or tuning dial shifted	1)	drop in value of ½-megohm plate resistor in AVC tube circuit

ZENITH LH

Weak reception	1)	6-mfd. electrolytic filter condenser "open." Replace
Weak reception, Hum	1)	6-mfd. electrolytic filter condenser "shorted"
Hum	1) 2) 3)	"open" 8-mfd. electrolytic filter condenser "leaky" 0.05-mfd. a-f coupling condenser. Replace "open" 0.2-mfd. 47 tube grid bias bypass condenser

ZENITH MH

Intermittent reception due to intermitt. oscill. action	1) 2) 3)	resolder all coil connections check oscillator condenser for faults replace oscillator coil

ZENITH 4-B-106, 4-B-131, 4-B-132—(Chassis 5406)

See also Case History listed for Zenith 4-Z-31 receiver

Inoperative on low-frequency end of dial	1) 2)	connect a 10,000-ohm resistor across 15 oscillator tube in order to reduce bias voltage on it moisture collected on coils. Move oscillator coil and shield about ½ inch or more away from chassis
Inoperative (oscillator not functioning)	1)	remove oscillator coil, place ⅛-inch insulating spacing washers over mounting lugs, and reassemble

(Cont'd over)

ZENITH 4-B-106, 4-B-131, 4-B-132—(Chassis 5406)—*(Cont'd)*

Inoperative (pilot light burned out)	1)	as pilot light is connected in series with the two type 15 tube filaments, set will not operate if pilot is burned out. Replace with 2.9-volt bayonet type bulb. Must be exact replacement, for proper receiver operation
Noisy	1)	replace type 15 tube in first r-f stage —even if it checks O.K.
Code interference, Hiss when passing through stations while dialing	1)	twist wire leading from 75 tube cathode around the condenser leading from the control grid of same tube. Both leads go to volume control

ZENITH 4-B-231 (Chassis 5409)

Vibrator hash (on all but local stations)	1)	replace 0.5-mfd. 400-volt paper condenser across input filter condenser *C-11*

ZENITH 4-F-133 (Chassis 5407)

Inoperative (pilot light burned out)	1)	as pilot light is connected in series with two type 15 tube fiilaments, set will not operate if pilot burns out. Replace with 2.9-volt bulb. Exact replacement must be used for proper receiver operation

ZENITH 4-F-227 (Chassis 5408)

Short "B" battery life, Poor tone quality after batt. voltage has dropped below 120 volts	1)	by-pass the plate voltage circuit with a 4-8-mfd. condenser. Also, convert the circuit to use automatic bias (eliminating the "C" battery. To do this, disconnect negative "B" lead where it connects inside chassis, and connect a 300-ohm ¼-watt carbon resistor in series to chassis. Run the bias leads from the 1H4G grid and 1K6G grid to the "B" lead (*yellow*). Disregard *green* lead, as "C" battery is omitted

ZENITH 4-K-310 (Chassis 5412)

Inoperative	1)	leakage between prongs of 1H5G diode socket and chassis. Replace

ZENITH 4-K-401

Whistling or squealing	1)	replace 1A7 tube
Motorboating sound	1)	poor "grounding" rivet connection on electrolytic condenser. Solder connector to chassis

ZENITH 4-P-26, 4-T-26 (Chassis 5401)

Squealing, Signal cuts out when vol. cont. is advanced	1)	"open" 2-mfd. screen by-pass condenser on the 6A7 tube

ZENITH 4-T-26 (Chassis 5403)

Whistling or squealing, Hum	1)	check condenser block *No. 22-407* for "shorts" or "opens". Replace

ZENITH 4-V-31, 4-V-59 (Chassis 5405)

See also Case Histories listed for Zenith 4-B-131 receiver

Inoperative at low-frequencies	1)	check battery voltage. Replace batteries if low
	2)	if battery voltage is O.K. replace the type 15 oscillator-first-detector tube
	3)	check 600-kc padder *C-2*. Replace
Intermittent reception	1)	faulty 200 to 550-mmfd. low-frequency padding condenser *C-2*
Audio oscillation (on 4-V-31 receiver)	1)	unsolder *blue* lead from *plate* term. of 38 socket and change it to the speaker socket—raising lead high above all other wiring. Unsolder lead to "high" side of vol. control and re-run it close to chassis

ZENITH 4-Z-31

Inoperative from around 700 kc down	1)	replace type 15 tube
	2)	replace also the oscillator coil assembly with type wound on impregnated wood. Oscillator coil in this receiver absorbs considerable moisture in humid localities, making it impossible to make oscillator circuit track properly

ZENITH 5-F-233, 5-F-251 (Chassis 5522)

Same Case Histories as listed for Zenith 4-F-227 receiver

ZENITH 5-G-500

Distortion when switched to a-c, or d-c	1)	check 140-ohm micamold resistor (*part No. 62-1096*) and the wire-wound resistor, or the 2-section candohm (*part No. 62-1120*), 1060 ohms on each side

ZENITH 5-G-635, 5-G-636

Inoperative	1)	"open" output transformer
Intermittent reception	1)	check tube socket contacts for insufficient spring tension. Tighten contacts
	2)	check tube base pins and socket contacts for dirt and corrosion. Clean

ZENITH 5-M-191 (Chassis 5520) Auto Radio

Intermittent operation Noisy, Poor tone quality (all when car is in motion)	1)	tuning cable inserted too far into condenser coupling, causing condenser to be held solid instead of floating on rubber washers
	2)	check antenna connectors for poor or loose contact, resulting in noise

ZENITH 5-R-303 (Chassis 5528)

Inoperative or weak on automatic tuning	1)	"open" 50-mmfd. condenser *C-2* (Part *No. 22-289*)

ZENITH 5-R-312 (Chassis 5528)

To increase bass response	1)	shunt a 0.02-mfd. condenser across the 0.02-mfd. audio coupling condenser already in receiver. Also connect a 0.01-mfd. 600-volt condenser across the 0.002-mfd. unit connected between plate and B-plus of power output tube

ZENITH 5-S-29, 5-S-56 (Chassis 5513)

Weak reception on "C" band	1)	check primary of 16-meter coil (*No. 10*) for "open" or poorly soldered joints

ZENITH 5-S-119, 5-S-126, 5-S-127, 5-S-150, 5-S-151, 5-S-161 —(Chassis 5516)

Noisy reception	1)	faulty i-f transformer. Resolder all joints in transformers. If noise still persists, replace faulty units

ZENITH 6-B-107, 6-B-129, 6-B-164 (Chassis 5635)

Distortion	1)	decreased capacity of 8-mfd. filter condenser in power pack. Replace

ZENITH 6-D-116, 6-D-117, 6-D-118 (Chassis 5633)

Inoperative	1)	"open" 0.02-mfd. tubular condenser connected to one of the end terminals of volume control. Replace condenser, and leave enough slack in leads so operation of volume control will not pull on condenser terminal
Weak reception	1)	replace i-f stage bias resistor with a 300-ohm unit
Squealing at low-frequency end of dial	1)	wind about 5 widely-spaced turns of thin double-cotton-covered wire (about No. 28) around grid lead of 6K7G tube. Ground the end nearest the chassis, leaving other end free and insulated from grid clip

ZENITH 6-D-311 (Chassis 5646)

Inoperative (all parts check O.K. and set lights up)	1)	check the two 50-ohm resistors connected from switch to ground
Whistling or squealing when tuning a station or adjusting volume	1)	"ground" the speaker frame
Noisy volume control	1)	"open" filter condenser
	2)	faulty volume control
Distortion	1)	"open" output tube cathode bias resistor. Also see that back chassis bolts are not making contact with a filament prong on output tube
	2)	replace 60-ohm and 50-ohm resistors *No. 9* and *No. 10*
Poor tone, Weak reception (after playing a while)	1)	check 25L6 output tube
Hum	1)	"shorted" speaker field winding—usually the two leads going into the winding are shorted together where they join the winding

ZENITH 6-D-312 (Chassis 5647)

Inoperative (all parts check O.K. and set lights up)	1)	check the two 50-ohm resistors connected from the switch to ground
Inoperative (ballast tube blown)	1)	faulty 40-mfd. condenser *C-9* connected to 25Z6 tube cathode. Replace this. Replace ballast tube
Weak reception, Poor tone (after playing a while)	1)	faulty 25L6 output tube

(Cont'd)

ZENITH 6-D-312 (Chassis 5647)—*(Cont'd)*

Distortion (tubes all light)	1)	replace 60-ohm and 50-ohm resistors *No. 9* and *No. 10*
To increase the bass response	1)	shunt a 0.01-mfd. condenser across the 0.002-mfd. unit already in the circuit. Also shunt a 0.02-mfd. condenser across the 0.02-mfd. unit already connected from plate to ground

ZENITH 6-D-410 (Chassis 5659)

Excessive regeneration	1)	dress 12A8G grid lead away from oscillator section of gang condenser

ZENITH 6-G-500

Inoperative	1)	"open" 0.01-mfd. coupling condenser connected from 1LH4 plate to 1LB4 grid

ZENITH 6-J-230 (Chassis 5642)

Distortion	1)	check to see if one pilot light is out. Replace

ZENITH 6-M-90D, 6-M-90S—(Chassis 5630)

Inoperative, Intermittent, Noisy (especially when jarred)	1)	check for broken or loose ground leads to 600-kc padder, tuning condenser, oscillator coil, and first-detector coil. Resolder

ZENITH 6-M-91D, 6-M-91S—(Chassis 5631)

Same Case Histories as those listed for Zenith 6-M-90

ZENITH 6-M-192 (Chassis 5632), 6-M-193, 6-M-194 (Chassis 5637)

Noisy when receiver is jarred	1)	check i-f coil shields which are grounded through one eye-bolt on can. Solder a ground lead to cross-bar on top of can. Tighten nuts holding cross-bar
	2)	resolder all soldering lugs on tuning gang stator
Vibrator hash	1)	bond r-f oscill.-det. coil shield cans to chassis. Solder all riveted ground lugs

ZENITH 6-MF-490, 6-MF-590—(Ford)

Varying reception, Noise, Whistling	1)	loose rivets on r-f and i-f transformer can grounding lugs. Bond all cans securely to ground

ZENITH 6-MN-495 (Nash Special AC4398)—(Chassis 5673)

Weak reception	1)	check second i-f transformer trimmers for "short" to mounting

ZENITH 6-R-481 (Chassis 5675)

Hum	1)	ground the common *negative* circuit to chassis
	2)	open the connection between the Wavemagnet shield and external ground lead, and insert a 0.01-mfd. condenser in it

ZENITH 6-S-27, 6-S-52 (Chassis 5619)

Tuning dial slips	1)	worn belt drive. To replace, remove entire dial assembly, making sure to remove back washer on the shaft

ZENITH 6-S-128, 6-S-137, 6-S-147, 6-S-152, 6-S-157 (Chassis 5634)

Inoperative	1)	"open" voltage divider section between screen tap and B plus end of voltage divider. Replace with 10,000-ohm 10-watt unit
Intermittent reception	1)	try new tubes
	2)	poor contact in voltage divider. Try pulling firmly upon the lugs, and working lugs back and forth
	3)	do same with audio coupling condenser. Check it also for "open"
	4)	poor internal contact in volume control
Weak reception, No s.w. reception	1)	"open" 1,100-ohm screen-grid section of voltage divider
Weak on broadcast band	1)	check for "open" in short-wave antenna coil winding (is in series with broadcast winding)
Vol. control ineffective at "minimum" end	1)	faulty 2-megohm volume control. Replace
Squealing at high volume	1)	loss of capacity in filter condensers. Replace

ZENITH 6-S-203, 6-S-222, 6-S-223, 6-S-229, 6-S-239, 6-S-241 (Chassis 5638)

I-f oscillation	1)	antenna circuit i-f trap is directly under 2nd i-f transf. Solder flat piece of metal in place to shield trap from the hole under this transf.

ZENITH 6-S-527 (Chassis 6A02)

Noisy reception	1)	see if right hand pilot light wiring is being "pinched" by automatic bracket
	2)	"loose" or "poor" contacts on pilot lights
	3)	poor contact on "manual" push-button
Whistling or squealing on short-waves	1)	dress *black* lead of automatic away from automatic adjustments. Dress *white-and-green* leads of automatic away from 7L7-7H7 socket

ZENITH 6-S-580 (Chassis 6A04)

Same Case Histories as those listed for Zenith 6-S-527

ZENITH 6-S-596 (Chassis 6A20)

Troubles in automatic record changer	1)	loose lever on tone-arm vertical shaft
	2)	"binding" in bearing of tone-arm vertical shaft

ZENITH 7

Intermittent reception	1)	faulty voice coil. Be careful when replacing voice coil, as there is very little "clearance"

ZENITH 7 Jr. Auto Radio

Erratic operation of volume control	1)	imperfect grounding of i-f shield can. Tighten i-f can mounting bolts and bond the can to the chassis with flexible braid soldered in place

ZENITH 7-M-91D, 7-M-915—(Chassis 5706)

Inoperative, Intermittent, Noisy	1)	check for broken or loose ground leads to 600-kc padder, tuning condenser, oscillator and first detector coil. Resolder

ZENITH 7-S-28 (Chassis 5704)

Whistling or squealing	1)	disconnect 6K7 first audio tube from common-bias system. Insert a 3,500-ohm ½-watt resistor by-passed with a 0.25-mfd. condenser in cathode circuit. Connect grid-return to chassis
Distortion	1)	realign i-f circuits carefully

ZENITH 7-S-204 (Chassis 5709)

Inoperative on broadcast band (O.K. on short-waves)	1)	"shorted" 10-mfd. condenser *C-21* in antenna transformer
Weak, noisy reception, Tuning eye inoperative	1)	replace 1-megohm resistor connected between plate and target of 6T5 tuning eye socket
	2)	"leaky" 25-mmfd. coupling condenser connected between antenna coil and preselector coil. This is white unit (looks like a resistor) mounted inside of preselector coil. Replace with mica condenser

ZENITH 7-S-242, 7-S-258, 7-S-260, 7-S-261 (Chassis 5709)

Inoperative on broadcast band (O.K. on short-waves)	1)	"shorted" 10-mmfd. condenser (*C-21*) in antenna transformer

ZENITH 7-S-323 (Chassis 5714)

Inoperative or noisy on automatic tuning	1)	dirty contacts
	2)	warped contact strip "shorting" to ground
	3)	"shorted" compensating condenser
	4)	"open" compensating coil *No. 3* (Part *No. 20-196*)
Whistling, Noisy between stations	1)	"open" filter condenser
	2)	"open" condenser or (loose connection) across r-f choke
	3)	"leaky" 0.002-mfd. 600-volt condenser connected across speaker leads

ZENITH 7-S-432 (Chassis 5719)

Weak reception (voltages below normal)	1)	decrease in capacity of 30-mfd. 250-volt electrolytic condenser *C-19*. Replace

ZENITH 7-S-432 (Chassis 5724)

Signal cuts out at high-freq. end of dial	1)	loosen setting of 5 mc. trimmer slightly
Signal cuts out on "local-distance" switch	1)	try new 6A8 tube
Weak audio	1)	"open" coupling condenser
	2)	poor contact in television switch
Whistling or squealing	1)	"open" screen by-pass condenser
	2)	wave trap "open" or not properly adjusted
	3)	dress 6K7 grid lead away from avc lug and 6A8 plate lead

(Cont'd)

ZENITH 7-S-432 (Chassis 5724)—*(Cont'd)*

Noisy tuning on automatic	1)	poor contact in speaker socket
	2)	washer on latch bar of push-button assembly "grounding" to lug
	3)	automatic trimmer "shorting"
	4)	poor contact on band switch
No change on "treble" button	1)	insulation on *blue* tone control lead being cut by fastening lug
To improve operation of "bass" Radiorgan button	1)	connect a 1-megohm resistor from "high" side of volume control to tap on same

ZENITH 7-S-487 (Chassis 5725)

Same Case Histories as those listed for Zenith 7-S-432 (Chassis 5724) receiver

ZENITH 7-S-529 (Chassis 7A02)

Inoperative	1)	480-mmfd. condenser on automatic grounded against automatic frame or latch bar
Whistling or squealing	1)	dress leads of wave trap close to chassis, keeping them away from antenna coil

ZENITH 7-S-581 (Chassis 7A04)

Same Case Histories as those listed for Zenith 7-S-529 receiver

ZENITH 8-S-129, 8-S-154 (Chassis 5801)

Inoperative	1)	"open" screen-voltage resistor section in voltage divider
Inoperative around 6 mc on B band	1)	replace 6A8G oscillator tube with a Sylvania 6A8 metal tube
Fading, Weak reception, (accompanied by little action on target tuning indicator)	1)	try a new 6C5G tube. If target tuner now fails to work, reverse the connections to the meter
	2)	resolder all connections on antenna coil
	3)	check 700-ohm resistor in cathode circuit of 6C5G
	4)	try connecting a 1,000-ohm resistor in cathode circuit of 6C5G tube
	5)	"shorted" 0.05-mfd. by-pass condenser on r-f input side of 6C5 shadowmeter grid

ZENITH 8-S-359 (Chassis 5807)

Hum	1)	faulty 6U5/6G5 tuning eye tube
	2)	faulty filter condenser

ZENITH 8-S-432 (Chassis 5810)

Weak reception (voltages below normal)	1)	decrease in capacity of 30-mfd. 250-volt electrolytic condenser *C-19*
Intermittent whistling or howling	1)	loose-i-f tube shield imperfectly grounded

ZENITH 8-S-443 (Chassis 5808)

"Blocking" of signal	1)	"open" resistor in avc circuit of first detector
Tuning indicator inoperative	1)	loose lead in tuning indicator socket
	2)	resistor inside tuning indicator socket "shorting" to socket prong
	3)	cathode lug on voltage divider "grounded" by solder
Automatic inoperative	1)	"open" winding on compensating coil
Noisy tuning	1)	dial pulley rubbing against dial or chassis
	2)	"ground" braid of gang rubbing against flywheel
	3)	burrs on drive shaft "shorting" to volume control shaft
Whistling or squealing around 500 kc	1)	adjust wave trap
	2)	reduce resistance in plate circuit of 1232 tube

ZENITH 8-S-458 (Chassis 5810)

Noisy when receiver is jarred	1)	replace tube shields with shields of smaller diameter

ZENITH 9-S-30, 9-S-54, 9-S-55 (Chassis 5903)

Hum	1)	change both 6F6 power tubes
	2)	check all condensers. Replace "leaky" or otherwise faulty units

ZENITH 9-S-203 (Chassis 5905)

Weak reception, Squealing when volume control is advanced	1)	"open" 8-mfd. condenser *C-21* in block *No. 22-571*
Fading	1)	"shorted" i-f trimmer condenser

ZENITH 9-S-262 (Chassis 5905)

Inoperative (no plate voltage on 6L7G first det. and 6K7G i-f tube)	1)	"shorted" 0.05-mfd. condenser *C-8*
Whistles when volume control is advanced	1)	replace 12-mfd. electrolytic condenser connected across "high" voltage-divider tap
Dial slips	1)	if belt is O.K., tighten clutch spring screw on flywheel shaft underneath front of chassis

ZENITH 9-S-307 (Chassis 5907)

Distortion (similar to avc blocking)	1)	"open" filter condenser section

ZENITH 9-S-365 (Chassis 5906)

Weak reception, Squealing	1)	"open" 8-mfd. condenser *C-21* in block *No. 22-571*
Fading	1)	"shorted" i-f stage trimmer condenser
Howling	1)	faulty 0.05-mfd. condenser in avc circuit. Replace with 400-volt unit

ZENITH 10

Inoperative	1)	0.03-mfd. audio coupling condenser "shorting" to chassis due to exposed foil touching chassis. Replace
Intermittent reception, Noise	1)	faulty coupling condenser in resistance-capacity coupled stage. Replace with a 0.1-mfd. 400-volt unit
	2)	0.03-mfd. audio coupling condenser "shorting" to chassis due to exposed foil touching chassis. Replace
	3)	corroded or loose contacts on 3-point antenna switch
Inoperative	1)	audio coupling condenser short-circuited to chassis
Whistling or squealing, Fading	1)	open-circuiting 0.1-mfd. screen by-pass condenser
	2)	open-circuiting 0.1-mfd. cathode by-pass condenser
Microphonic hum	1)	change type '24-A detector tube

ZENITH 10-S-130, 10-S-147, 10-S-153, 10-S-155, 10-S-156, 10-S-157, 10-S-160 (Chassis 1004)

Inoperative on "B" band below 6 mc (early models)	1)	replace 6A8G oscillator tube with Sylvania 6A8 metal tube
Intermittent reception	1)	check all tubes
	2)	"shorting" i-f trimmers
	3)	dirty variable condenser
	4)	poor ground at Candohm resistor
	5)	loose wire link across Z and G on aerial connection strip
	6)	poor contact on band switch
	7)	faulty aerial
	8)	faulty by-pass condenser
Lack of sensitivity (on all bands)	1)	check tubes
	2)	check antenna and ground
	3)	check all coils
	4)	poor contact in sensitivity switch
	5)	re-align entire receiver
Lack of sensitivity (on broadcast band)	1)	open r-f plate choke
Weak reception	1)	check all tubes, especially 1st and 2nd detector tubes
	2)	try grounding the receiver. If it does not help, or introduces hum, try reversing the a-c line plug—or leave ground off entirely
	3)	"open" 2nd detector cathode resistor or Candohm
	4)	"grounded" 0.00025-mfd. condenser in tone circuit (noticeable on high-fidelity position of switch, with distortion)
	5)	re-peak i-f's to 456 kc
	6)	check tone switch for "short" to "Foreign station" lug
Weak reception (target tuner does not function)	1)	"shorted" 0.05-mfd. by-pass condenser on r-f input side of 6C5 target tuner grid
Stations "ride" in	1)	check alignment of receiver
	2)	check 0.0012-mfd. condenser in oscillator plate circuit

(Cont'd)

ZENITH 10-S-130, 10-S-147, 10-S-153, 10-S-155, 10-S-156, 10-S-157, 10-S-160 (Chassis 1004)—*(Cont'd)*

"Off calibration" at low-freq. end of dial. Unable to adjust by regular alignment	1)	check 600-kc padder for broken wire, lug, etc.
	2)	check 0.0012-mfd. condenser *C-26* (*No. 22-486*) in oscillator plate circuit
Poor action of target tuner	1)	target tuner is not supposed to center exactly in center of bull's eye, except on very strong input signal
	2)	check 6C5 tube, or replace target unit
Noisy on all bands	1)	try a ground on the receiver. If it does not help, or introduces hum, try reversing the a-c line plug, or leave ground off entirely
	2)	check tubes for noise
	3)	check condenser bond wires to clear chassis
	4)	dirty tuning condenser or wipers
	5)	loose lugs on Candohm resistor
	6)	"shorted" bus bar wires in coil circuits
	7)	noisy aerial connections
	8)	loose connecting wire between Z and G on aerial terminal strip
Noisy on "C" band only in spots	1)	check dial pulley—move pulley away from dial pan
	2)	condenser bonds do not clear chassis
	3)	check for poor contacts on the band, tone and sensitivity switches
	4)	faulty volume control
	5)	faulty 16-mmfd. condenser *No. 22-506*
Hum	1)	check all tubes
	2)	"shorted" elements in oscillator tube, or output tubes not matched
	3)	"open" filter condenser
	4)	"open" electrostatic shield in power transformer. This will give "carrier hum," and can be corrected by by-passing the a-c line with a 0.001-mfd. mica condenser. Try reversing the a-c line plug also
"Fluttering" at low frequency	1)	check all tubes carefully—particularly the oscillator tube
	2)	rebalance i-f's to 456 kc
Dial slips	1)	loose dial clutch. Tighten

ZENITH 10-S-443 (Chassis 1005)

Same Case Histories as those listed for Zenith 8-S-443 receiver

ZENITH 11

Same Case Histories as listed for Zenith 10 receiver

ZENITH 11E (A-C)

Inoperative, Intermittent reception	1)	"open" in the r-f grid circuit
	2)	"shorting" compensating condenser on condenser gang. Place a small piece of gummed paper over the inside of one plate

ZENITH 11-S-474 (Chassis 1103)

Same Case Histories as those listed for Zenith 8-S-443 receiver

ZENITH 12

Same Case Histories as listed for Zenith 10 receiver

ZENITH 12-A-57, 12-A-58 (Chassis 1202)

Excessive deep tone at all tone control positions	1)	remove 0.01-mfd. condenser *C-10*

ZENITH 12-L-57, 12-L-58—(Chassis 1202A)

Intermittent reception	1)	replace 0.05-mfd. condenser *C-29* coupling 6H6 tube to volume control *R-7*
Tuning meter operation not sensitive enough	1)	try new 6C5 tube

ZENITH 12-S-265 (Chassis 1204)

Inoperative (no screen voltage on 6K7G and 6L7G tubes)	1)	"open" 11,000-ohm section in Candohm resistor
Microphonic noises, Low rumbling (with vol. control at minimum)	1)	microphonic 6J5G first a-f tube

ZENITH 12-S-445 (Chassis 1207)

Distortion (sounding like blocking avc action)	1)	"open" filter condenser section

ZENITH 12-S-550 (Chassis 12A3)

Hum	1)	replace first audio 6J5 tube

ZENITH 12-U-158, 12-U-159 (Chassis 1203)

Inoperative	1)	if audio stages O.K. but r-f end is dead, check 5-meter coil for "open" circuit (broken loose from condenser gang terminal)
	2)	check gang and trimmer condensers for "shorts"
	3)	check for "open" coils and "shorted" by-pass condensers
	4)	check for "open" resistor in 1st audio plate circuit
	5)	check for shorted filter condensers
Inoperative on lowest wave band	1)	untwist grid lead wires from screw on gang condenser. Realign, using 0.001-mfd. mica condenser from oscillator to antenna
Weak reception, (poor sensitivity)	1)	check tubes
	2)	check r-f and i-f alignment
	3)	check coils for "open" circuits—particularly the 2nd detector coil
	4)	"open" r-f choke in plate circuit
	5)	broken grid wires
	6)	check fixed condensers grouped around volume control

(Cont'd)

ZENITH 12-U-158, 12-U-159 (Chassis 1203)—*(Cont'd)*

Lack of sensitivity on ultra-short-wave band	1)	extreme pickup cannot be expected on this band. However, the following will affect operation on this band
	2)	"open" oscillator coil
	3)	"open" or shorted 0.0012-mfd. 600-volt condenser *C-7* in oscillator plate circuit
	4)	"shorted" 50-mmfd. condenser across the high-freq. coil
	5)	"grounded" trimmer on the 1st detector section of gang condenser
	6)	"open" 5-ohm resistor at high-freq. coil will cause "spotty" sensitivity
	7)	check first-detector tube, as it has a great effect on ultra-short-wave reception
	8)	do not alter the length of wires, positions of coils, etc., as this will affect the entire short-wave band operation. Leave (or replace all units) in exactly the position they were in when set was shipped from factory
Lack of sensitivity on "D" band	1)	faulty 6H6, 6L7 tubes
	2)	"open" coil winding
	3)	poor contact at tube prongs
	4)	poor contact on band switch
	5)	check i-f peak (456 kc)
	6)	"shorted" 0.25-mmfd. condenser in oscillator circuit
	7)	check coupling of wires in "D" band circuit
Stations "ride" in	1)	check alignment of receiver
	2)	check 0.0012-mfd. 600-volt condenser *C-7* in oscill. plate circuit
"Off scale" (gain is low, and difficult to line up the tuning circuits)	1)	check for "open" 20-ohm resistor (*R-16*) in screen circuit of 1st detector
	2)	check 50-mmfd. condenser (*C-4*) in oscillator circuit. Replace when necessary
Broadcast band "off scale"	1)	check the dial pointer. The pointer should line up across the dial scale parallel to the line when the gang condenser plates are fully meshed
	2)	the air trimmer for the "B" band, as shown in the earlier circuit diagrams and listed on the service sheets, is not used on later models. The "Broadcast" and "D" band trimmers are in the same positions as shown on these sheets. Follow the usual alignment procedure
Noisy on "D" band	1)	clear the gang condenser bonds away from the chassis holes
	2)	check wiring of "D" band tuned circuits for "shorts"
	3)	check coils for loose soldering on lugs
Noisy and "off-scale" on "D" band	1)	replace the 50-mmfd. condenser in the oscillator circuit
Noisy	1)	where noise is definitely traced to the chassis (after tubes, antenna, and ground systems have been checked), check contacts on band switch, sensitivity switch, volume control, coil wires, air trimmers and 16-mfd. screen condenser *C-21* as possible noise sources
Distortion	1)	check all tubes
	2)	output tubes mismatched
	3)	"open" 16-mfd. electrolytic condenser (*C-21*) in screen circuit

(Cont'd over)

ZENITH 12-U-158, 12-U-159 (Chassis 1203)—*(Cont'd)*

Distortion	4)	"shorted" 10-mfd. electrolytic condenser (*C-20*) in output tube cathode circuit
	5)	"open" cathode circuits
	6)	faulty by-pass condensers
	7)	"grounded", or "shorted" tone circuit
	8)	faulty loud speaker
	9)	if distortion is accompanied by loss of output, check for "shorted" 0.005-mfd. condenser (*C-22*) in plate circuit of one of the output tubes
	10)	distortion only when tone switch is on "normal" may be caused by a "short" between the lugs on the tone switch
Distortion at low volume	1)	replace 400-ohm 1-watt cathode resistor on 6F6 tube with a 5-watt wire-wound unit
	2)	check cathode by-pass condenser for leakage
Poor reproduction on high-frequency notes	1)	poor contact on tone switch
	2)	"open" 0.00025-mfd. condenser (*C-15*) in tone control circuit
	3)	"open" tap on volume control (in this case, the tone control will have no effect)
Carrier or modulation hum	1)	faulty 6C5, 6H6, or power tubes
	2)	"open" electrostatic shield in power transformer. Try reversing the a-c line plug. Try connecting a 0.001-mfd. 400-volt mica condenser from one side of power line to receiver chassis
	3)	"shorted" 0.005-mfd. condenser (*C-22*) in output tube plate circuit
	4)	"grounded" tap on volume control
	5)	"open" Candohm resistor ground

ZENITH 14

Same Case Histories as listed for Zenith 11E receiver

ZENITH 15E, 15EP

Weak reception, Distortion (no detector plate voltage)	1)	poor connection or an "open" in 100,000-ohm detector plate resistor (mounted in a clip at audio end under chassis)

ZENITH 15-S-308 (Chassis 1502)

Tuning scale settings change	1)	"loose" Parker-Kalon screws in gang condenser gear hub

ZENITH 15-S-497 (Chassis 1503)

Poor Radiorgan action	1)	faulty 6F8G audio tube
Improper volume control action	1)	faulty 6J5G audio tube

ZENITH 15-U-269 (Chassis 1501)

Weak reception (accompanied by noise)	1)	"open" 6K7G r-f plate choke (Part *No. 20-135*)
Microphonic noises, Low rumbling (with vol. control at minimum)	1)	microphonic 6J5G first a-f tube

(Cont'd)

ZENITH 15-U-269 (Chassis 1501)—*(Cont'd)*

Troubles with split-dial mechanisms	1)	carefully lubricate all bearings and tighten all set-screws—especially the two that hold lever on waveband switch. Entire dial assembly will jam if these work loose

ZENITH 16, 16E, 16EP

Same Case Histories as those listed for Zenith 15E receiver

ZENITH 33, 33X, 34, 34P, 35, 35A, 35P, 35AP

Inoperative	1)	"open" section in voltage divider
	2)	"shorted" filter condenser in power pack
Intermittent reception, Noisy tuning	1)	variable condenser plates blistered and peeling, causing shorts. Burn with high voltage—all leads disconnected
Intermittent reception, Fading	1)	dirty or loose socket contacts
	2)	defective volume control
	3)	defective audio transformer
Weak reception, (audio circuits test O.K.)	1)	open-circuited, or omitted 2,000-ohm resistor from ground to movable antenna compensating coil under chassis. Replace with a new resistor
Poor selectivity, Hum, Whistling or squealing when volume control is turned toward maximum	1)	open-circuited antenna primary coil located in inverted can below the first r-f tube socket under the chassis. Replace with new unit or solder a flexible lead which has a phone tip soldered to its other end to one terminal of a 0.01-mfd. condenser. Plug the end with the phone tip into the "long antenna" tip jack and ground the other end of the condenser to the chassis. Re-align circuits for maximum response
Tone raspy	1)	substitute a '112 tube for the '71 tube
Noisy reception	1)	high-resistance ground in secondary of original a-f transformer (green corrosion usually found on terminal lugs)
Hum	1)	defective electrolytic filter condenser. Short-circuit the terminal of each unit momentarily to chassis and note the effect—the hum might be cured. If not, replace with new units
	2)	connect 100,000-ohm resistor across type 27 first-audio tube grids
	3)	defective type '27 tube
	4)	defective volume control
	5)	"open" cathode by-pass condenser in detector stage
Hum,	1)	"short" from heater to cathode in any of the '27 tubes

ZENITH 35PX

Noisy reception, Poor tone quality	1)	noisy audio transformers. Replace

ZENITH 37A

Fading (on phono)	1)	check all leads to pickup for loose connections and poorly soldered joints. Resolder all these joints

ZENITH 39A

Poor sensitivity	1)	realign tuning condensers. Remove condenser gang shield to get at the trimmer
	2)	corroded wire connection on terminal strip which plugs into power pack

ZENITH 41, 42

Inoperative (no screen grid voltage)	1)	check two 25,000-ohm resistors associated with screen circuit. Replace
Inoperative (no r-f plate voltage)	1)	"short" in the first compensator condenser. Trim and bend it so it will not "short"
Fading, Noisy reception, Whistling or squealing	1)	defective contacts in "local-distance" toggle switch. This connects to a 0.00025-mfd. condenser in antenna circuit
	2)	loose or broken terminal lug on r-f plate circuit by-pass condenser
Hum	1)	check all leads to pickup for loose center tapped resistor "shorting" to chassis
	2)	when replacing the shield cans be sure that all wires are placed in their proper grooves

ZENITH 50

Excessive hum	1)	**inductive pickup from the filter choke by the a-f transformer between the first and final a-f stages. Remove the blocking condenser between the plate of the first a-f stage and the a-f transformer primary; shunt the transformer primary with a 0.1-megohm resistor. Connect the "low" end of this resistor through a 2-mfd. by-pass condenser to ground. Now connect in series with the "low" end of the audio transformer primary and B-plus a 0.1-megohm resistor. Disconnect the former connection of that part of the a-f transf. primary to ground**
	2)	faulty '24 detector tube
	3)	increase plate coupling condenser in 1st a-f stage from 0.05 to 0.1-mfd. Use value giving best results
	4)	connect a 100,000-ohm resistor in the det. plate return circuit. Connect a 500,000-ohm resistor in the det. screen circuit. By-pass each of these resistors to ground by a 0.1-mfd. by-pass condenser
Poor sensitivity at one end of dial	1)	remove shield from condenser gang. Remove screens holding stators in place at each end. Place lockwashers under these, and tighten
Fading	1)	faulty volume control
	2)	poor connection in grid circuit of first r-f stage. Resolder all connections

ZENITH 52, 53, 54, 55 ("50" Series)

Inoperative	1)	"open" 400-ohm (*yellow*) r-f bias resistors
	2)	"open" 2,000 ohm (*black*) audio bias resistors
Type '80 tubes burn out	1)	automatic tuner pilot light or socket shorting to metal frame

(Cont'd)

ZENITH 52, 53, 54, 55 ("50" Series)—*(Cont'd)*

No signals on certain wavelengths	1)	variable condenser plates blistered and peeling, causing short-circuits. Burn with high voltage—all leads disconnected
No reception below 650 kc	1)	end rotor plates of tuning condensers shorting to stator plates
Weak reception, Intermittent reception, Flickering of pilot light	1)	intermittent short-circuiting of the two filament supporting stems in the pilot lamp, thus also short-circuiting the filaments of the type '45 power tubes, across which it is connected. Replace lamp
Fading, Intermittent reception	1)	**"cold-soldered" connections to variable condensers**
	2)	**"open" r-f coils, leads snap at lug**
	3)	worn carbon resistance in volume control
	4)	**break in pigtail to r-f stator vernier of first r-f tuning condenser**
	5)	snapping of fine wire leads of r-f chokes at eyelets
	6)	"open" between pilot lamp bracket and tuning dial
	7)	defective cathode by-pass condenser
Noisy tuning, Whistling or squealing	1)	corroded copper contact and washer at end of condenser gang rotor shaft. Add jumpers from rotor wipers to ground, and from center gang shield to ground
Hum	1)	defective electrolytic filter condenser. Short-circuit the terminal of each unit momentarily to chassis and note the effect—the hum may be cured. If not, replace with new units
	2)	connect 100,000-ohm resistor across type 27 first-audio tube grids
	3)	defective type '27 tube
	4)	defective volume control
	5)	"open" cathode by-pass condenser in detector stage
	6)	place 500,000-ohm resistor across secondary of push-pull input transformer
	7)	"open" r-f choke in first r-f grid return circuit

ZENITH 55-127, 55-150

All signals but locals fade out completely after short period of operation	1)	replace 400-ohm ½-watt 6A8G cathode resistor (mounted directly on tube socket near front of chassis)

ZENITH 60

Same Case Histories as those listed for Zenith 50 receiver

ZENITH 61

Hum	1)	check electrolytic filter condensers
	2)	cathode-to-heater "short" in detector tube

ZENITH 62

Weak reception	1)	warping of die-castings in tuning condenser causes set to go out of alignment. Realign while set is warmed up well
Whistling or squealing around lower end of dial	1)	this is a normal condition in this receiver, as long as it can be checked by the volume control

(Cont'd over)

ZENITH 62—*(Cont'd)*

Hum	1)	often, after replacing the wet electrolytic condenser on these models a hum will be heard, and "forming" the plates of the electrolytic condenser will remove the hum only for a short time To remedy this, disconnect the leads from the electrolytic condenser one at a time. When the correct wire is removed, the hum will be lower in volume. This is the section shunting its resistance across the filter choke, allowing the hum content of the power supply to be passed through the resistance and not through the filter choke. To this wire which has been removed connect an 8-mfd. electrolytic condenser thence to ground (chassis)

ZENITH 70

Intermittent reception	1)	replace 100,000-ohm *white* detector plate resistor
Intermittent reception accompanied by distortion	1)	replace 0.03-mfd. plate blocking condenser in 1st a-f stage
Intermittent reception and fading	1)	if signals vary from weak to normal to weak, etc., check for "open" or "shorted" 0.25-mfd. dual plate by-pass condenser for first two r-f stages
	2)	if signals fade to weak and stay weak, replace 0.03-mfd. first audio plate blocking condenser located between plate of first audio tube and primary of first a-f condenser
Intermittent reduction in volume, accompanied by sharp "click" and ragged tone	1)	replace first-audio plate blocking condenser
Volume dies down after set is in operation for few seconds, requiring readjustment of volume control	1)	replace 100,000-ohm *white* detector plate resistor
Distortion on low volume	1)	"leaky" 1st-audio coupling condenser. Replace
Hum	1)	by-pass the detector cathode to ground with a 1 or 2-mfd. condenser supplementing the one already in the circuit

ZENITH 71P

Inoperative	1)	"shorted" filter section on either side of choke coil. Cut "shorted" lead; connect in an 8-mfd. electrolytic condenser with its *negative* side to the choke; *positive* lead goes to connector strip

ZENITH 71, 72, 73, 77 ("70" Series)

See also Case Histories listed for Zenith 52, 53, 54, 55 receivers

(Cont'd)

ZENITH 71, 72, 73, 77 ("70" Series)—*(Cont'd)*

Fading, Weak reception	1)	open- or short-circuited 0.25-mfd. dual plate by-pass condenser connected in the first and second r-f stages. Replace
	2)	"open" or "shorted" 0.03-mfd. audio coupling condenser. Replace
Noisy reception	1)	defective a-f transformer
Hum	1)	see Case History listed for this same trouble symptom under Zenith 62 receiver

ZENITH 75-C

Motorboating sound	1)	defective dual 0.01-mfd. condenser. Replace with new unit

ZENITH 90

Inoperative	1)	defective 8-mfd. dry electrolytic filter condenser. Replace with new unit

ZENITH 91, 92

Inoperative, until '24 AVC tube is withdrawn	1)	"open" AVC voltage divider section. Connect a 15,000-ohm 1-watt wire-wound resistor across that section which is between the AVC tube cathode and the screen grid taps
Weak reception, Poor tone	1)	check value of resistor in screen cathode audio center-tap circuit. Portion between center-tap and cathode should measure 2500-ohms. Section between cathode and screen shield should be 10,000-ohms
	2)	faulty r-f choke
	3)	"open" 0.5-mfd. second det. cathode bias condenser
Fading and whistling or squealing	1)	replace '24 AVC tube
	2)	check for "open" 0.5-mfd. screen by-pass condensers of r-f and i-f stages
Fading No dip action on tuning meter, Erratic operation on "local" side of local-distance switch	1)	change in resistance value of the 2,800- and 3,600-ohm bleeder resistors connected in series across the d-c output voltage. Replace with resistors of higher wattage rating
No AVC action	1)	defective AVC resistor
Distortion at resonance	1)	AVC screen-cathode voltage divider changed in value
Local-distance switch inoperative	1)	open-circuited 4.5-megohm carbon resistor
Interference from airport radio beacon stations which transmit at 260-kc, (the i-f of the receiver)	1)	readjust the i-f compensating condenser at 250- or 270-kc
Alignment of receiver circuits impossible	1)	defective gang condenser. Replace with new unit
Impossible to align circuits at 1400-kc	1)	open-circuited 0.001-mfd. condenser between the oscillator coil and plate of oscillator tube. Replace with 0.0005-mfd. condenser and set will align O.K.

ZENITH 102, 112, 122

Same Case Histories as those listed for Zenith 10 receiver

ZENITH 134F

Weak reception, Noisy	1)	check both i-f transformers with a low-range ohmmeter. If more than 10-ohms, replace transformer

ZENITH 230 Transformer (Chassis 2036)

Distortion at low volume	1)	improperly centered voice coil of either dynamic speaker
Hum, Distortion	1)	capacity of electrolytic filter condensers dropped below normal
Whistling or squealing, Weak and distorted	1)	capacity of third electrolytic filter condenser dropped below normal
Motorboating sound,	1)	insufficient filter capacity. Add an additional 4-mfd. condenser to the filter

ZENITH 240 (Chassis 2036)

See also Case Histories listed for Zenith 230 receiver

Set does not tune to proper frequency setting of tuning dial	1)	oscillator trimmer condensers out of alignment
	2)	celluloid dial scale requires adjustment
Distortion, Weak reception	1)	back left mounting bolt screwed up too far, causing it to short-circuit to bias resistor

ZENITH 244 (Chassis 2036)

See also Case Histories listed for Zenith 230 receiver

Poor tone, Distortion at low volume	1)	defective type '57 AVC tube (even though it tests O.K.). Replace with new tube
	2)	improperly centered voice coil on the large speaker. Re-adjust the voice coil

ZENITH 245 (Chassis 2036)

Same Case Histories as those listed for Zenith 230 receiver

ZENITH 342, 342P, 352, 352A, 352AP, 352P, 362, 362X

Same Case Histories as listed for Zenith 33X receiver

ZENITH 410, 411, 420

Inoperative	1)	open-circuited shadowgraph tuning meter
Fading after a few minutes of operation	1)	replace type AVC '57 tube
Hum (present only when stations are tuned in)	1)	partially short-circuited field coil, putting a greater load on the line and thereby lowering the plate voltages supplied to the tubes. Replace the field coil
Hum	1)	faulty electrolytic filter condensers
Rapid motorboating sound (no radio reception)	1)	"open" 500-mmfd. condenser across plate and cathode of 56 second detector

ZENITH 422

Same Case Histories as listed for Zenith 41, 42 receivers

ZENITH 430, 440—(Chassis 2033)

See also Case Histories listed for Zenith 410, 411, 420 receivers

Weak reception	1)	partial "short" in 0.5-mfd. condenser connected in second-detector plate circuit (at left side of chassis, alongside of volume control)
Weak reception, Noisy	1)	poor connections at riveted ends of i-f transf. trimmer condensers. Solder the ends, and realign at 175 kc

ZENITH 460 Auto Radio (Chassis 2047)

Weak reception at high-freq. end of dial	1)	7000-ohm ¼-watt resistor in detector plate has changed in value. Replace

ZENITH 462 (Chassis 2057)

Vibrator trouble	1)	vibrator operates only for half-wave rectification. Inspect to see if a piece of solder is "shorting" at the other contact to the armature, or if the armature is adjusted improperly
Howling	1)	during a portion of the production, the suppressor grids were removed from the cathodes and tied to the grid returns thereby placing the AVC voltage on the suppressor grids. Also a change was made in the first i-f stage, a 6C5 being used instead of a 6D6. This was to eliminate the tendency towards howling. These changes may be also made on the older production receivers when this trouble is experienced with them

ZENITH 474 (Chassis 2053)

Same Case Histories as listed for Zenith 755 receiver

ZENITH 475 (Chassis 2054)

Same Case Histories as listed for Zenith 760 receiver

ZENITH 476B (Chassis 2059)

Inoperative	1)	check for "open" ¼-watt 99,000-ohm diode load resistor on 56 diode second detector tube

ZENITH 500, 501, 503, 514, 515, 516 (Chassis 2037)

Intermittent reception, Whistling or squealing, Motorboating sound, Station hiss	1)	open-circuiting 0.5-mfd. grid filter condenser for r-f, i-f and first detector stages

ZENITH 522, 532, 542

See also Case Histories listed for Zenith 52 receiver

Inoperative	1)	"open" *yellow* 400-ohm r-f bias resistor
	2)	"open" black 2,000-ohm audio bias resistor

ZENITH 600, 604, 606 (Chassis 2037)

Same Case Histories as listed for Zenith 500 receiver

ZENITH 608 (Chassis 2035)

Intermittent reception, Volume cuts down to lower level	1)	open-circuiting r-f first detector, i-f secondary-return by-pass condensers

ZENITH 610, 616, 618 (Chassis 2037)

Same Case Histories as listed for Zenith 500 receiver

ZENITH 666, 668 (Chassis 5616) Auto Radio

Weak reception	1)	replace 6C6 tube
Noisy while going over rough roads. O.K. when set is on test bench	1)	remove cover from set and replace the 3 wires on the top of the variable condenser unit with very flexible wire
	2)	loose nut that holds oscillator coil to the can. The nut is located under the tuning condenser gang. Remove chassis to tighten it

ZENITH 701

Inoperative	1)	defective electrolytic filter condenser
Weak reception	1)	if all parts and tubes check O.K., replace filter condenser block
Hum	1)	defective 25-5-10 mfd. electrolytic filter condenser. Replace with new unit

ZENITH 705, 706, 707, 711, 712 (Chassis 2052)

Inoperative, type '58 i-f tube grids get red hot	1)	shorted primary-secondary windings of i-f transformer
Inoperative at high-frequencies	1)	intermittent oscillator plate by-pass condenser
Intermittent reception, Whistling or squealing, Motorboating sound	1)	open-circuiting 0.1-mfd. i-f secondary-return by-pass condenser
Changes in volume	1)	"leaky" 0.01-mfd. condenser in oscillator circuit
Broad tuning	1)	remove the 5,400-ohm resistor and 5-mfd., 20-volt condenser in the cathode of the type '2A6 tube, grounding the cathode. This removes the QAVC feature of the receiver. Realign the i-f and r-f stages, before putting the set in operation
Whistling or squealing, Motorboating sound	1)	open-circuited 0.05-mfd. cathode by-pass condensers for first detector and i-f stages
	2)	electrolytic filter condenser making poor contact with the metal chassis. Turn the condenser about ⅛ turn to tighten it

(Cont'd)

ZENITH 705, 706, 707, 711, 712 (Chassis 2052)—*(Cont'd)*

Motorboating sound between stations	1)	defective 0.1-mfd. by-pass condenser in AVC circuit. Replace with new unit (Part *No. 22-190*)
Distortion, Glowing type '59 tube grids	1)	can of electrolytic filter condenser grounding to shield
	2)	connecting lug of electrolytic condenser grounding to chassis
Code interference	1)	shunt wave trap tuned to 485 kc across aerial and ground
Hum and distortion	1)	faulty volume control. Try replacing it with a 1-megohm unit—even if it checks O.K.

ZENITH 715 (Chassis 2053)

Same Case Histories as listed for Zenith 705, 755 receivers

ZENITH 730 Series

Inoperative, Intermittent operation	1)	"shorted" i-f by-pass from primary to secondary
	2)	"shorted" i-f winding
Improving performance	1)	remove fine stranded enameled wires of i-f coils where they pass through eyelets at base of coil form, and run externally through spaghetti, sharpening i-f resonance peak due to reduced coupling. Realign

ZENITH 750 (Chassis 2052)

See also Case Histories listed for Zenith 705, 706, etc. receivers

Inoperative (grids of i-f tube red hot)	1)	"shorted" i-f transformer (often caused simply by leads of one winding touching leads of the other winding)
Intermittent reception	1)	defective type '59 tube (even though it may test O.K.). Replace with new tube by substitution
Motorboating sound	1)	type 89 tube weak on low-frequencies. Try reversing i-f primary terminal connections
	2)	replace 0.5-mfd. cathode by-pass condenser of 1st detector and i-f tubes with 400-volt non-inductive units

ZENITH 755, 756 (Chassis 2053)

Inoperative, (d-c output shorted)	1)	type '58 r-f plate coil lead grounding to chassis
Inoperative, Very weak	1)	open-circuited 15,000-ohm screen voltage dropping resistor
Oscillator inoperative below 850 kc	1)	absorbed moisture in antenna coil. Replace with new unit, or dry out moisture and dope coil with a good doping compound
Weak reception, Distortion, Low plate voltage on type '55 tube	1)	leaky first audio plate by-pass condenser

(Cont'd)

ZENITH 755, 756 (Chassis 2053)—*(Cont'd)*

Intermittent reception, Whistling or squealing	1)	open-circuiting r-f, first detector and i-f secondary-return by-pass condensers
Fading after few minutes of operation	1)	faulty heavy-duty resistor connected from filter condenser to push-pull audio transformer
Noisy reception at low volume, Steady popping	1)	replace type 55 second detector and AVC tube
Distortion, Poor AVC action	1)	leaky r-f, or first detector secondary-return by-pass condensers
Hum	1)	add extra filter choke between type '80 filament and speaker field and connect an 8-mfd. electrolytic condenser after filter choke to chassis
Hum at resonance	1)	cathode-heater leakage of type '56 oscillator tube

ZENITH 760, 765, 767 (Chassis 2054)

Intermittent reception, Fading, Motorboating sound	1)	open-circuiting r-f, first detector and i-f secondary-return by-pass condensers
	2)	check 15,000-ohm resistor (*Part No. 63-301*) for decreased value. Replace with 10-watt unit
Whistling or squealing, Hum	1)	add 8-mfd. electrolytic filter condenser after first speaker field to chassis
	2)	add additional filter choke between '80 tube filament and first speaker field, and connect 8-mfd. electrolytic filter condenser from '80 filament to chassis
Hum (after regular values of filter condensers have been installed)	1)	by-pass the 0.5-mfd. by-pass condenser next to the primary of the input transformer with an 8-mfd. electrolytic condenser
Hum at resonance	1)	cathode-heater leakage of type '56 oscillator tube
Distortion	1)	by-pass the center-tap of the volume control resistor to ground with a 0.00015-mfd. mica unit, thereby reducing the r-f load on the grid of the first a-f tube and allowing greater a-f amplification
Distortion, Poor AVC action	1)	leaky or short-circuited secondary-return by-pass condensers

ZENITH 770 (Chassis 2032)

Inoperative	1)	open-circuited shadowgraph
	2)	open-circuited audio coupling condenser
Very weak, Distorted reception	1)	open-circuited audio coupling condenser
No AVC action, Distortion at resonance	1)	open-circuited AVC grid-coupling condenser
Motorboating sound between stations	1)	open-circuiting r-f, first detector and i-f secondary-return by-pass condensers

(Cont'd)

ZENITH 770 (Chassis 2032)—*(Cont'd)*

Hum at resonance	1)	cathode-heater leakage in type '56 oscillator tube
Intermittent reception, Cutting off upon vibration	1)	type '58 tube bias resistor grounding lug loose
Inoperative, Shadowgraph functions normally, Intermittent reception	1)	open-circuiting audio coupling condensers
	2)	open-circuiting diode audio coupling condensers
Intermittent reception, Fading, Whistling or squealing, Station hiss	1)	open-circuiting grid filter condensers in r-f, i-f and first detector secondary return circuits
Intermittent reception	1)	leaky insulation in AVC resistor by-pass condenser lead. Slip a piece of spaghetti over this lead

ZENITH 770B (Chassis 2059)

Inoperative	1)	check for "open" ¼-watt 99,000-ohm diode load resistor on 56 diode second detector tube

ZENITH 775 (Chassis 2032)

Same Case Histories as listed for Zenith 770 receiver

ZENITH 775B (Chassis 2059)

Inoperative	1)	check for "open" ¼-watt 99,000-ohm diode load resistor on 56 diode second detector tube

ZENITH 801

Weak reception	1)	if all parts and tubes check O.K., replace filter condenser block

ZENITH 805, 807, 809

Inoperative over part or all of tuning range	1)	"leaky" 0.0.1-mfd. oscillator plate coupling condenser (connected between oscill. plate prong and oscill. coil). Replace with 600-volt unit
Insensitive, Inoperative above 900-kc	1)	short-circuited oscillator plate condenser. Replace with 0.01-mfd. unit (Part *No. 22-276*)
Fading, Distortion	1)	gassy 42 tube
	2)	faulty 0.02-mfd. coupling condenser. Replace with 600-volt unit
Distortion (Model 807)	1)	occasional "short" in 0.005-mfd. condenser which connects band switch to ground by one of the many terminals on the switch

ZENITH 835 (Chassis 1001, 1001A)

Intermittent reception, Fading, Inoperative	1)	open-circuiting 0.02-mfd. audio coupling condenser
	2)	rear right chassis bolt tightened too much
Whistling or squealing, Motorboating sound	1)	open-circuited 0.1-mfd. r-f screen by-pass condenser

ZENITH 870 (Chassis 5701-2-3)

Inoperative below 700 kc	1)	check for "shorted" or "leaky" 0.01-mfd. 400-volt condenser in oscillator plate circuit

ZENITH 880 (Chassis 1001, 1001A)

See also Case Histories listed for Zenith 835 receiver

Distortion, AVC tube blocking	1)	short-circuited 0.0004-mfd. condenser in first r-f coil can (Part *No. 22-285*)

ZENITH 970, 975 (Chassis 5902)

Inoperative, Screen voltages on r-f, i-f and translator tubes only 20 volts, Positive indication from control grids to ground	1)	Screen drop resistor short-circuiting to diode load resistor. Clear by moving
Intermittent reception, Popping noises	1)	open-circuiting diode audio coupling condenser
	2)	intermittent short-circuiting of screen-voltage dropping resistor to diode load resistor
	3)	open-circuiting r-f grid filter condenser

ZENITH 980, 985, 990 (Chassis 1201, 1201A)

Weak, Noisy, Broad tuning	1)	check d-c resistance of primary and secondary windings of i-f transformer. If it is much above 5 or 6 ohms, replace transformer

ZENITH "Stratosphere" 1000 Z (Chassis 2501)

Weak, distorted reception	1)	check driver transformer (*1*) for "open" or "short". The audio signal will be weak, and a hum will be evident if this transformer is shorted
	2)	"open" 1,500-ohm resistor (*R-28*) in cathode circuit of first audio stage
Poor low-freq. note reproduction, High-freq. note reproduction over-accentuated	1)	"open" center-tap on driver transformer (*1*)
	2)	"open" condenser (*C-14*) in cathode circuit of 85 tube
	3)	"grounded" 50,000-ohm resistor (*R-4*) on tone control
	4)	"shorted" section in "low-boost" transformer
Motorboating sound on all bands	1)	"open" 0.5-mfd. condenser connected to the 85 tube socket
"Fluttering" as tone control is rotated	1)	"open" or "shorted" 0.1-mfd. condenser (*C-4*) in the tone control circuit

USE THIS SPACE FOR RECORDING CASE HISTORIES OF ADDITIONAL MAKES & MODELS OF RECEIVERS

END

— 2 —

I-F TRANSFORMER CONSTRUCTION, TROUBLES, SERVICING and REPLACEMENT

(Also, Correction of Oscillation in I-F Amplifiers)

Importance of the I-F Transformer

The i-f amplifier has aptly been called "The Heart of the Superheterodyne" since it contributes most of the selectivity and amplification achieved in it. Because they form such a vital part of the i-f amplifier, it is important that the radio service man have a good working knowledge of the construction, characteristics, uses, replacement, and repair of the various forms of i-f transformers used in the superheterodynes he is called upon to align and service. He should also know how to recognize and correct common troubles encountered in the i-f amplifiers. It is for this reason that the following important copyrighted technical data on i-f transformers and i-f amplifiers—*which is reprinted here by special permission and courtesy of the Meissner Manufacturing Co.*—has been presented ahead of *Section 3* on *Superhet Alignment* and the *Chart of I-F Peaks* (*Section 4*) in the hope that it will serve its purpose in helping service men to understand better the construction and operation of i-f transformers and the common troubles in i-f amplifiers, so they may more efficiently and quickly solve their i-f amplifier servicing problems. The author is especially grateful to the *Meissner Manufacturing Co.* for special permission to reprint this material here, for, in his opinion it is the most thorough and helpful data of its kind ever published on this subject.

The Various Forms of I-F Transformers

"The intermediate frequency transformers used in radio receivers have been built in a variety of forms, and have operated at many different intermediate frequencies. They may be divided into several classes according to the number of selective circuits they contain:

(*1*) *untuned, or self-tuned*
(*2*) *single tuned*
(*3*) *double tuned*
(*4*) *triple tuned*

Receivers have also employed other special band-pass arrangements usually intended to provide improved "skirt" or "flat-top" selectivity characteristics in the i-f amplifier. Such cases, however, are comparatively rare. The types listed above are those most usually encountered and will be discussed in the following paragraphs.

Untuned I-F Transformers

The principal purpose of the untuned i-f transformer is to provide high amplification at very little cost. It adds practically no selectivity to the receiver and is always used in conjunction with one or more tuned i-f transformers which supply the required selectivity.

Single-Tuned I-F Transformers

The single-tuned i-f transformer has taken two important forms, the bi-filar coil and the double coil types.

In the former case, the two wires constituting primary and secondary are wound simultaneously, forming a coil that is a single physical unit but yet has two independent circuits. The start of the primary is usually the plus "B" connection and the start of the secondary is "*ground.*" The outside of the primary is the *plate* connection, and the outside of the secondary is the *grid* connection. These transformers are characterized by very high gain and comparatively little selectivity. They are used on receivers that are not provided with automatic volume control (avc), and the secondary low-potential end is usually connected directly to chassis. Such a transformer could not be used satisfactorily in a receiver employing the conventional diode type avc circuit, for the reason that on damp days there is enough electrical leakage between the primary and secondary windings to produce a decidedly positive bias on the grids of the automatically controlled tubes.

In addition, such a structure possesses such a high capacity between windings that the ripple in the "B" supply would be transferred to the diode load resistance. This would produce a bad audio hum in the output of the receiver. A third reason why this type of transformer would not now be acceptable, even if there was no diode load resistance to pick up hum or to be biased incorrectly, is the frequent failure of windings due to electrolytic corrosion. Where two conductors are run so intimately parallel for so many turns, with opposite d-c potentials applied to the two wires, ideal conditions are set up for rapid failure due to electrolytic corrosion in the presence of moisture.

With this type of transformer redesigned to have two physically separate coils wound side by side, the objectionable features of electrical leakage, corrosion and hum transfer are reduced to a very small per cent of their original importance, and transformers acceptable in today's critical market can be produced.

Single-tuned transformers may be divided into two classes according to the circuit tuned—some have their *primaries tuned,* while the remainder have their *secondaries* tuned. As far as secondary voltage is concerned, there is not a great deal of difference regardless of which winding is tuned, but if there is a question of single-stage oscillation in the tube driving the single-tuned transformer, greater stability is had by tuning the *secondary* than by tuning the primary.

Double-Tuned I-F Transformers

The double-tuned i-f transformer is, by far, the most popular type. It is simple in construction, has negligible electrical leakage, no measurable hum transfer into diode circuits and can have its selectivity curve made as sharp as two single-tuned transformers in cascade. Furthermore this transformer can be considerably broader at the "nose" of the selectivity curve than two cascaded single-tuned transformers, yet on the broader part of the selectivity curve maintain practically the same width as the cascaded single-tuned transformers.

If the coupling of a double-tuned transformer is made sufficiently loose, the transformer is quite selective and has a

resonance curve of the same general shape as a single circuit, except sharper. As the coupling is increased, the gain will go up until the point of "critical coupling" is approached where the gain of the transformer is practically constant but the selectivity curve is changing, particularly at the "nose" of the curve. As the coupling continues to increase, first there is a decided flattening of the nose of the selectivity curve, after which continued increase in coupling produces an actual hollow in the nose of the curve. Still greater increase in coupling can spread the two "humps" and deepen the "hollow" in the nose of the response curve. This condition of overcoupling is not generally found in Broadcast receivers but is quite useful in applications requiring a wide bandpass characteristic.

Band-Expanding I-F Transformers

A modification of the double-tuned transformer often encountered is the band-expanding type. In this transformer, the pass-band is varied by changing the coupling between primary and secondary. This is usually accomplished by means of a third winding consisting of a relatively few turns of wire wound under, over, or adjacent to one main winding. Switching this third winding in series with the other main winding provides the extra coupling required to produce a broad selectivity curve. In some cases this third winding is tapped, providing an intermediate degree of selectivity. By this arrangement a very high per-cent change in coupling can be accomplished with practically no change in the self-resonant frequency of the circuit which has been switched.

Another system sometimes employed utilizes a mechanical means of changing the spacing between primary and secondary.

Iron-Core I-F Transformers

These transformers are usually of the double-tuned variety. The essential difference, of course, is the presence of the special compressed iron-dust cores which make possible coils with higher "Q". Consequently this type of transformer has improved gain and selectivity. Iron-core i-f transformers may be divided into two classes according to the method of tuning. One type uses the ordinary ceramic trimmer, while the other type uses high-stability, low-loss "silvermike" condensers. In the latter case, tuning is accomplished by changing the position of the iron-core. If the unit is mechanically sound, this arrangement provides unusual stability.

Capacity Coupling in I-F Transformers

Variations in mechanical coupling cause variations in the gain and selectivity of i-f transformers as described in foregoing paragraphs. This, however, is not the only source of variations. Variations in capacity coupling can be equally as important in transformers operating above 400 kc. This statement applies with even greater emphasis as the frequency or the "Q" of the coil is raised.

The capacity that is effective is that which exists between any part of the plate end of the primary circuit and any part of the grid end of the secondary circuit or, to be more specific, the capacity between:

(1) *the plate and grid sides of the trimmer condensers*
(2) *the plate and grid ends of the coil*
(3) *the plate and grid leads*
(4) *the grid lead and the plate end of the primary coil*
(5) *the plate lead and the grid end of the secondary coil*

Double-tuned i-f transformers may be built with the magnetic coupling either *aiding*, or *opposing*, the capacity coupling. For reasons of production economy, both coils are usually wound simultaneously on one dowel, which means they must be wound in the same direction. For reasons of production uniformity the *insides* of both windings are usually chosen as the high-potential ends of the coil so that the outside (low-potential) ends of the coils will automatically act as spacers to keep the high-potential hook-up wires from approaching the high-potential ends of the coils.

If transformers are designed so that the circuits are considerably under the "Critical Coupling" condition, variations in capacity coupling are equally important whether the magnetic coupling aids or opposes the capacity coupling. In the former case, an increase in capacity coupling will *raise* the gain of the transformer while in the latter case an increase in capacity coupling will *reduce* the gain of the transformer (except in the very rare cases where capacity coupling predominates).

If the transformer is at "critical coupling" and the magnetic and capacity couplings are "aiding," an increase in capacity coupling will merely *decrease* the selectivity, while if the couplings are "opposing," an increase in capacity coupling will *increase* the selectivity and *reduce* the gain.

In all of the above cases, the effect of *increasing* capacity coupling is mentioned because transformers are ordinarily built with a certain irreducible minimum capacity and any changes must necessarily be additions.

Whether capacity coupling *aids* or *opposes* the magnetic coupling in a given transformer may be determined by inspection. If the coils are wound in the *same* direction, which is the usual case, the magnetic coupling *opposes* the capacity coupling if both grid and plate are connected to the same ends of their respective coils. Ordinarily both grid and plate are connected to the inside ends of the coils in order to keep the high-potential ends of the coils away from the hook-up leads passing the coil.

Triple-Tuned I-F Transformers

Triple-tuned i-f transformers have been used for two general purposes: greater adjacent-channel selectivity without increasing the number of tubes and transformers, or a better shape of the nose of the selectivity curve to produce better audio fidelity than is produced by double-tuned transformers. Capacity coupling in such transformers is of even greater importance than in double-tuned transformers, especially where both plate and diode hook-up wires come out at one end of the transformer shield, as is the usual case with output i-f transformers.

Designing I-F Transformers

Special precautions and constructions are employed in building Meissner i-f transformers. Every design is fully engineered and quality is always the first consideration.

From an engineering viewpoint, the coils used in any particular i-f transformer are carefully designed for maximum performance. Such design includes consideration of size, form-factor, distributed capacity, inductance, type and diameter of wire and treatment after winding. As many of these factors depend directly upon the selection of a suitable wire with absolute uniformity in insulation characteristics it will be readily apparent that the availability of the Wire-Serving Department in controlling these factors is a distinct advantage.

The designing engineer is therefore able to determine from exhaustive laboratory tests whether litz (individually insulated stranded wire), or solid wire would be more suitable for the coil under consideration. If litz wire is to be used, he will then decide upon the number of strands and the diameter of each strand. If solid wire is found to be suitable, the diameter will be quickly determined. The best type and thickness of insulation can then be decided upon for the wire selected.

After determining the desired characteristics of the wire and insulation, he can then specify these requirements to the production department (however, "special" or unusual they may be) with the assurance that these specifications will be carried through to produce exactly the type of coil which he has designed.

The trimmer plates are silver plated and made of tempered brass alloy to maintain constant tension over long periods of time. Only the best grade of selected India Ruby mica is used as a dielectric. Adjusting screws have extra fine threads to provide vernier adjustment of capacity.

Finished transformers are inspected both visually and elec-

trically, and as a final check, the selectivity curve of every transformer is viewed with an oscillograph.

I-F Transformer Repair Procedure

There are two general plans of repair procedure when an i-f transformer fails: (1) replace the entire unit; and, (2) replace only the coil windings.

Each plan fits a definite set of circumstances but many service men, failing to realize this, or hesitant to follow the most appropriate plan, have turned out repair work with which they were not satisfied, and which in some cases did not satisfy their customers. In order to aid service men to turn out the best repair job with the minimum expenditure of time and at a maximum of profit, the following discussion of the problem (insofar as it concerns i-f transformers) gives typical examples of trouble and shows which plan of procedure is most advisable.

When is it Advisable to Replace Faulty I-F Transformer Windings Rather than Replace the Entire Unit?

It is obvious upon comparing the price of a replacement i-f coil winding with the price of a complete replacement i-f transformer, that the material cost in replacing only the defective winding is less than the cost of replacing the entire transformer, yet few service men can afford to replace only the coil winding when a satisfactory replacement transformer is available! The labor involved in installing and adjusting the coil windings more than offsets the difference in cost of replacement parts. However, there is a very definite place for replacement i-f coil windings.

The following list gives a number of typical cases where it is better, more convenient, or more desirable to replace only the coil windings, rather than to substitute a complete new transformer:

(1) When there is no replacement transformer small enough to fit in the position occupied by the original transformer.

(2) When the shield on the original transformer has special mounting feet, brackets, shields or other structural elements attached that would be difficult to transfer to the proposed replacement transformer, or if the shield has holes, notches or other cut-outs that would require considerable labor to duplicate on the replacement transformer.

(3) Where a standard replacement transformer would look unsightly in a highly polished or otherwise ornamented custom-built receiver whose owner is particularly proud of the appearance of his set.

(4) Where the material cost for repair parts must be kept to an absolute minimum and an extra hour of work is not prohibitive.

(5) Where the faulty transformer has a special circuit which is not available in a standard replacement i-f transformer, in which case it is usually possible to replace the one faulty coil winding instead of searching for a complete replacement winding or complete replacement transformer.

Typical of such cases are afc discriminator transformers, delayed avc transformers with two secondaries, step-down ratio output transformers having the diode load across only part of the secondary, step-down ratio input or interstage i-f transformers in which the grid has been tapped-down to obtain low gain-per-stage so that several stages might be used.

(6) In cases where a number of sets of the same model are to be repaired, where the spacing of replacement windings may be determined on one set and this information used in repairing the remaining sets.

How to Select Correct Replacement I-F Transformers to Accomplish Various Desirable Results

By far the greater number of radio receivers employ only one i-f amplifier tube, which means that both the input and output i-f transformers must have high gain if the set is to have adequate sensitivity. Even in cases where an r-f stage is employed, the gain produced by a pair of high-gain i-f transformers is seldom objectionable. In the few cases where a set may be too sensitive because of the use of a high-gain replacement transformer, the sensitivity can always be reduced by a shift in either cathode bias or screen voltage. It can therefore usually be assumed that the correct replacement i-f transformer for a set with a single i-f stage should be of the high-gain type.

If it is desirable to improve the adjacent-channel selectivity of a receiver, this can be accomplished by installing i-f transformers having greater selectivity than those previously in use. If the original transformer had only fair selectivity, it is recommended that iron-core transformers be installed. If the original transformers had good selectivity, but still higher selectivity is desired, install triple-tuned i-f transformers. In the latter case the additional tuned circuit will add substantially to the selectivity of the receiver and with less possibility of restricting the audio quality than might be the case where iron-core transformers are employed.

When radio sets have two i-f amplifier tubes and three i-f transformers, the transformer windings employed produce comparatively low gain-per-stage, at least in the 1st and 2nd transformers. The last transformer, the diode driver, usually permits amplification comparable to that of a conventional "output" i-f transformer for a set with only one i-f tube. It must be realized that if one of these transformers is replaced with a high-gain transformer, it is probable that the circuit will oscillate. If the replacement transformer happens to have somewhat lower gain than the original transformer, the set would still be amply sensitive for normal reception. Following this idea, and considering that the 1st and 2nd i-f transformers usually have low gain in sets with three i-f transformers, the logical replacement for either the 1st or 2nd of these transformers is a proper "Interstage" transformer which was purposely designed to have low gain. The service man, with his signal generator and output indicator, can tell quickly whether use of such an "Interstage" replacement transformer (low-gain) has made the set too insensitive for satisfactory service. In those rare cases in which the sensitivity is too poor, it will be necessary to change the "Interstage" transformer for an "Input" transformer which has higher gain. If this practice of replacing either the 1st or 2nd transformer (of sets with three i-f transformers) by an "Interstage" transformer is followed, the number of cases in which it may be necessary to change the "Interstage" for a higher-gain unit will be far fewer than the number of cases of oscillation or excessive regeneration that it would be necessary to correct if high-gain transformers were always installed first.

Sets that employ two i-f tubes but only two i-f transformers usually employ a resistance-capacity coupling network between the two tubes in much the same fashion as a resistance-capacity coupled audio-frequency amplifier. The only essential difference lies in the values of the resistors and the condenser, in the frequency of the signal (i-f) and in the amplification produced, which is much lower than that produced by the conventional resistance-coupled audio stage. Such sets employ high-gain input and output i-f transformers and should be considered in this discussion as belonging to the type of sets having only one i-f stage.

How to Install Replacement I-F Transformers

The replacement transformer should be installed in the faulty receiver in as neat a manner as possible. It should be remembered that customers frequently judge the technical quality of repair work by the physical appearance of the finished job.

In some instances it may be necessary to drill new holes in the chassis for mounting the replacement transformer. A few minutes spent to lay out the holes properly so that the transformer, when mounted, will be appropriately spaced with reference to adjacent parts and will have its sides parallel to, or at right-angles to, prominent sides or edges of adjacent objects is a good investment. When replacement transformers are put on a chassis at odd angles with respect to adjacent parts, the customer is quite likely to undervalue the technical ability of the service man in direct proportion to his apparent lack of care in making the installation of the new parts.

In case the hole under the original transformer is too large to permit a replacement transformer to be mounted

over it, a flat metal strip should first be installed and the replacement transformer mounted on it. In some cases it may be possible, and with a consequent saving of time, to install the replacement transformer in the old shield can. In any case, the work should be done as neatly as possible.

The leads on the replacement transformer may have a different color code than the original transformer leads; consequently the original color code should not necessarily be followed. The popular i-f replacement transformers have the following color code (which is in accordance with the standard RMA color codes) unless otherwise specified:

INPUT & INTERSTAGE I-F TRANSFORMER COLOR CODE

Blue = Plate
Red = "B+"
Green = Control Grid
Black = AVC

OUTPUT I-F TRANSFORMER COLOR CODE

Blue = Plate
Red = "B+"
Green = Diode or Control Grid
Black = Grid or Diode Return
Green & Black = Full Wave Diode

This code of connections must be followed if proper results are to be obtained.

The position of the *blue* (plate) lead and the *green* (diode or control-grid) lead should be carefully chosen so as to be as far away from other grid or plate leads as possible. Usually the position of the original control-grid and plate leads is a reasonable guide to the best position for the leads of the replacement transformer. In cases of oscillation trouble that occasionally develops when the replacement i-f transformer has higher gain than the original transformer, the original lead positions may not necessarily be best, and a new position with greater separation between certain "hot" leads should be chosen. Grid and plate leads should always be as short and direct as possible. The length and path of the *red* lead is seldom of any consequence on any i-f transformer. The length and path of the *black* lead is seldom of any consequence on input or interstage transformers but on output transformers should be short and direct to the diode load resistance and should be kept close to the chassis.

When the faulty transformer is an output transformer, with the diode filter and perhaps part or all of the diode load resistors and condensers assembled in the same can, there arises the problem of what to do with these extra parts. *It is a good plan to remove every faulty transformer from its shield can and to check for the presence of such parts.* If the set is large, it is recommended that these extra resistors and condensers be assembled neatly on an insulated terminal strip installed under the chassis close to the replacement i-f transformer. This is, of course, not the best practice technically (the best practice would be to put the parts back into the new transformer), but it is a reasonable procedure in making a satisfactory repair with a minimum expenditure of time.

Objections to Use of Close-Fitting Shielding on Connecting Leads

The use of shielded connecting leads should be avoided because close-fitting shielding disturbs the i-f transformer characteristics in several ways. The first and most apparent effect of close-fitting shielding on the grid, diode, or plate leads is to add to the circuit capacity. This requires that the trimmer condenser in the transformer be operated at a correspondingly lower capacity.

If the shielded lead is long and the shielding is close fitting it is entirely possible that the amount of capacity added in the shielding may be more than the amount required to tune the transformer, in which case the trimmer will never "peak" but the output will only approach a maximum as the capacity is reduced. In a less exaggerated case, where the capacity added in the shielded lead is not enough to prevent the trimmer from "peaking," the "peak" may occur at a setting of the trimmer condenser that is too loose for stability when the transformer is subjected to mechanical vibration such as might be caused by the loudspeaker in the receiver, etc.

If the output changes materially due to vibration, the trimmer is probably too loose, and the shielding should be reduced to permit the trimmers to be worked at a more stable part of their capacity curves.

The second objection to shielding on grid, diode or plate leads is that the insulation on the hook-up leads CHANGES CAPACITY and POWER-FACTOR (losses) with changes in atmospheric humidity. These changes cause the sensitivity of the set to shift with the weather. These shifts in sensitivity can become very bad if excessive amounts of shielding are used.

The third objection to close-fitting shielding is that the insulation on ordinary hookup wire has relatively high r-f losses, lowering the "Q" of any circuit to which the shielded wire is connected.

In ac/dc sets of the Underwriters-approved types there is another objection to shielding on either the diode or diode-return leads when the shielding is connected to the chassis. In such sets the "B—" point in the set is isolated from the chassis and is by-passed to it by a condenser whose capacity does not exceed 0.25-mfd. Because of the capacity of various parts of the set to chassis, and because the isolating condenser is of limited capacity, the chassis is not at "B—", a-c potential nor, for that matter, is it at the potential of any other point in the set.

Across the isolating condenser appear audio frequencies from the filament supply as well as components from the half-wave rectified current. When a shield on a diode or a diode-return lead is connected to chassis, the hum voltages appearing across the isolating condenser are impressed by the shield onto the high impedance diode circuit, causing an audio hum voltage to appear across the volume control which, of course, is converted by the speaker into an audible hum. If the shielding is connected to the "B—" point in the chassis, this hum will not be present, but it will then be necessary to insulate the outside of the shielding so that it cannot ever come in contact with the coil shield, the chassis, or any other metallic object attached thereto. Unless this is done, someone may accidentally receive an unpleasant or even dangerous shock upon touching the chassis and any grounded object simultaneously. Where flexible-spring shielding has been used on one of the leads on the original transformer, it is usually good practice to use the same shielding on the corresponding lead of the replacement transformer. This is permissible because the shielding is not tight on the wire and because the length of shielding is seldom more than 2 or 3 inches. It is, in other words, a low-capacity shield.

On experimental sets that have not enjoyed competent engineering, long grid or plate leads have sometimes been employed without the builder being aware of the troubles that may result. When shielding is added to such leads, to eliminate troublesome coupling, it should be of large diameter such as is used on the "lead-ins" of auto-radio sets.

Aligning Receiver After Installing Replacement I-F Transformers

After the replacement transformer is installed, it should be aligned. It is true that all high-grade commercial replacement i-f transformers have been aligned in the factory and tested for gain and selectivity before shipment, but installing the transformers in receivers in which the circuit wiring has a different capacity than that which existed in the test set, coupled with the fact that the intermediate frequency of the receivers (see chart of *Receiver I-F Peak Frequencies* presented in *Section 4*) may be some kilocycles different from the frequency to which the transformers were adjusted in the factory, requires that the transformers be re-aligned after installation. The methods of routine aligning are explained in *Section 3* of this *Handbook*.

Objectionable Feedback and Oscillation in I-F Amplifiers

There will be a few sets in which the replacement

transformers will produce enough more amplification than the original transformer so that oscillation will result. The following discussion of the subject of oscillation gives an account of the most important methods by which feedback occurs and shows how oscillation caused by the feedback can be cured.

Feedback can be divided roughly into two classes:

(1) *Single-stage feedback*

(2) *Overall feedback*

Single-stage feedback is literally what the name signifies, whereas under the heading of "Overall Feedback" are considered all types of feedback involving more than 1 tube.

Causes of Single-Stage Feedback and Oscillation in I-F Amplifiers

Single-stage oscillation in amplifiers is usually the least understood type of regeneration trouble. It frequently baffles service men and experimenters. It is peculiar in that *no amount of filtering applied to plate supply, screen, cathode or avc circuit, nor any amount of shielding seems to make any improvement.* This form of trouble is seldom encountered in a set made by a reputable manufacturer, if the set is in its original condition and has the original set of tubes in the original sockets. Experimental sets, and sets that have had new i-f transformers installed in them, are far more likely to exhibit single-stage oscillation.

The enthusiastic amateurs or experimenters may select i-f transformers of the highest-possible gain characteristics for their sets and then wonder why they have so much difficulty making a single i-f stage behave; and why they have to use such abnormally high biases on their i-f amplifier tubes before stability is attained. The fact of the matter is that the grid-to-plate capacity of the i-f amplifier, although it is only 0.01-mmfd. or less, is the limiting factor in the amount of gain that can be obtained from a tube before oscillation results.

In order to obtain high gain from an amplifier, it is necessary that the coupling impedances be very high. To this end, i-f transformers have been built with higher and higher inductance and with better and better (higher-"Q") coils until, when used in an amplifier, the amplifier oscillates. If this oscillation persists even after completely shielding the stage and isolating the screen-grid, "B+", cathode and avc, the limit of amplification possible with that tube and circuit has been reached. Only by neutralizing the grid-to-plate capacity of the tube can circuits of higher gain be used. What actually occurs is that a part of the i-f voltage appearing in the plate circuit of the tube gets back through the grid-plate capacity of the tube and impresses itself on the grid circuit. If the amount of this *feedback* voltage is large enough and the impedance of the grid circuit is high enough, sustained oscillation will result in much the same fashion as the well-known "Tuned-Grid—Tuned-Plate" transmitting circuit performs. Technically speaking, it is also necessary that the phase relations be correct, but these can so easily be changed by slight adjustments of the trimmer that it is a foregone conclusion that the proper adjustment for oscillation will be obtained when the impedances are high.

Test for Single-Stage Oscillation in I-F Amplifiers

The most certain check for single-stage oscillation is to connect to the grid of the suspected tube the i-f probe of a good "Signal Tracing" service unit and to watch for indications of the presence of a strong i-f signal when the 1st and 4th circuits are detuned in opposite directions while the 2nd and 3rd circuits are left in alignment. If no "Signal Tracing Unit" is available, the following method may be used to check the single-stage oscillation: connect a milliammeter (which has been by-passed with a 1/10-mfd condenser) in series with the B+ lead of the output transformer. Detune the 1st and 4th circuits in opposite directions, then watch the milliammeter while an intermittent short-circuit is applied to the control-grid of the tube, meanwhile slowly shifting the grid trimmer slightly above and below resonance. If the plate current changes when the short-circuit is applied and removed, the circuit is changing from the oscillating to the stable condition, or vice versa.

Remedies for Single-Stage Oscillation in I-F Amplifiers

The remedies for single-stage oscillation are:

(1) Use of a close-fitting tube shield on the offending tube.
(2) Use a tube with lower grid-plate capacity.
(3) Use a tube with lower mutual conductance.
(4) Raise the bias on the present tube until oscillation stops.
(5) Use circuits of lower impedance.
(6) Neutralize the grid-plate capacity.

If the positions of the grid and plate leads of the i-f transformer are already located one above the chassis and the other below and if the tube has around it a close-fitting shield that is grounded to the chassis, there is nothing further that can be done from this standpoint to improve the situation. If these conditions are not all fulfilled, some improvement may be made by adding the tube shield or placing leads for lower coupling.

Concerning lower grid-plate capacity, it can be said that normally this parameter of tubes is quite constant, although occasionally there are a few tubes with capacities up to or even exceeding 10 times their normal value. It is always recommended that several tubes be tried in an oscillating i-f amplifier (realigning each time) before doing much work to determine the cause of oscillation or attempting to correct it.

It can also be said that some "G" or "GT" equivalents of metal tubes have appreciably more grid-plate capacity than the corresponding metal tubes. Therefore, if the tube giving trouble is a "G" or "GT" tube and the metal tube equivalent is available it is wise to try the metal tube, being sure however, to realign the circuits.

Concerning the use of a tube with lower mutual conductance, one might say that a simple remedy is to raise the bias on the offending tube until its mutual conductance is reduced far enough to establish stability.

The use of lower-impedance circuits is a very wise procedure for eliminating single-stage oscillation and is the method employed by qualified radio engineers when designing receivers. When high-impedance circuits are used and the i-f amplifier tube is biased-up to attain stability, the avc characteristic of the receiver suffers, the degree of control becoming less as the minimum fixed bias is increased. In Meissner replacement i-f transformers the circuit impedances were carefully chosen to prevent single-stage oscillation in practically all cases. There will still be found, however, a few sets in which the remaining good transformer has a high enough impedance to cause the stage to oscillate when a Meissner replacement transformer is installed. Such sets call for increased cathode bias to restore stability. The use of neutralized circuits in combination with screen-grid tubes is academically interesting and has been of practical interest in a few special cases, but normally such circuits are no longer used to any extent.

Since a complete understanding of single-stage oscillation involves a knowledge of circuit impedances, at least qualitatively, the following explanation of the changes in circuit impedances is given as a background for explaining a peculiar phenomenon. Service men have noticed cases in which some i-f amplifiers oscillate when some of the trimmers are out of adjustment and that, as alignment proceeds, the oscillation stops.

Anti-Resonance Oscillation. — When an inductance is shunted by a condenser a "resonant circuit" is formed in which the impedance is very high at the frequency to which the circuit is tuned, but the impedance drops off very rapidly

above or below this frequency, soon reaching a low value. At resonance the impedance is approximately equal to the product of frequency times 2 pi times the inductance in henries, times the "Q" of the circuit.

When two similar circuits are separated far enough so that they have no effect upon each other (are not coupled) and they are both tuned to the same frequency, they each have a definite high impedance, but if these circuits are brought progressively closer together (coupled) until "critical coupling" is reached, the magnitude of the impedance of each circuit will drop to approximately one-half of the original impedance when isolated from each other.

When the position of the coils of two tuned circuits is fixed (as in the conventional i-f transformer) and the trimmers are adjusted so that the circuits are tuned to vastly different frequencies (are electrically far apart), the impedance of each circuit is high at the frequency to which it is tuned. Now if one of these circuits is tuned to the intermediate frequency it will have its highest impedance at that frequency when the other circuit is tuned to a frequency far removed from it. But, as the frequency of the 2nd circuit is brought progressively closer to the intermediate frequency, the high impedance of the original tuned circuit begins to drop, until, when both circuits are resonant to the same frequency, the impedance of the original tuned circuit reaches its lowest value, approaching one-half of the original value if the coils are "critically coupled." When an i-f amplifier is stable with all circuits in resonance and oscillates when the 1st and 4th circuits are detuned in opposite directions, the oscillation is caused by the impedance of the 2nd and 3rd circuits reaching or exceeding the critical value as the 1st and 4th circuits are detuned.

All competent engineers designing radio sets test their designs for this type of trouble so that they will be sure that even though the i-f trimmers or coils may drift a little from exact alignment, the circuit impedances will not rise high enough to cause single-stage oscillation. Occasionally however, when sets have been designed to obtain the maximum sensitivity from average tubes, exceptionally high-gain tubes may cause oscillation with surprisingly little detuning. The usual remedy is to use a tube not quite so good or to raise the bias slightly.

Overall Feedback & Oscillation in I-F Amplifiers

Over-all oscillation is a familiar complaint in multi-stage t-r-f receivers, even of good design, and in i-f amplifiers of high gain. On experimental receivers in the process of development it may be produced by any one of a number of causes. Only by experiment can the offending source of coupling be discovered and removed. It may be of 2 general types, *high-impedance* or *low-impedance;* or might be considered as *voltage* feedback and *current* feedback although all feedback phenomena in radio receivers are, strictly speaking, voltage feedback phenomena.

Coupling between antenna and control-grid or plate leads, and couplings between control-grid leads or plate leads, etc., all of which impress relatively high voltages on the very small capacities existing between the points just mentioned, are classed as *high-impedance feedbacks.* Appropriate partition-type shielding quickly stops this type of feedback. Under the heading of *low-impedance feedbacks* are placed all oscillation troubles resulting from the use of common cathode, screen-grid or plate by-pass condensers, common leads in high-frequency circuits, couplings resulting from the common shaft of a gang condenser, etc. Eliminating oscillation from these sources requires a study of the receiver and many experiments, isolating the various circuits that are suspected of causing the feedback, until finally the real offender is discovered.

Sometimes feedbacks are *degenerative* instead of *regenerative* and the disconcerting fact may be discovered in some cases that isolation of certain circuits increases rather than decreases oscillation troubles.

On manufactured receivers made by a reputable company which attempts to keep uniform quality, over-all oscillation after some time in service can usually be traced to some circuit element that changes its electrical characteristics with age. For example, if no paper condenser is used across the electrolytic filter condenser to insure a permanent low-impedance r-f path to ground, over-all i-f oscillation can occur when the r-f resistance of the electrolytic filter condenser increases with age.

Common by-pass condensers also should be suspected as the cause of feedback. When they are, they may be usually found very easily by connecting a known good condenser across each by-pass condenser successively until the faulty unit is found.

Feedback and Oscillation in the I-F Amplifiers of AC/DC Receivers

In ac/dc receivers of the Underwriters-approved types, feedback is usually a serious design problem, because the chassis is not solidly connected to the "B—" point in the receiver but is merely by-passed to that point by a capacity not exceeding 0.25-mfd. This isolation of the chassis from the "B—" point, which is usually one side of the power line, is done to eliminate the hazard attached to a set that has its chassis connected solidly to the power line. For the same reason, the capacity allowed between the chassis and the minus "B" is limited to 0.25-mfd.

Since every alternating or pulsating voltage in the set causes some small current to flow through the capacity of the parts to the chassis, then through the isolating condenser and back to the "B—", there is in the input circuit of the receiver (which includes the isolating condenser) a mixture of frequencies, amplitudes and phases which is impossible to predict. Some of the voltages are regenerative, some degenerative, some cause trouble at any setting of the gang condenser, while others cause trouble only over a limited range of positions of the dial (usually at the low-frequency end). When oscillation troubles result after replacing an i-f transformer there are two logical remedies possible.

(1) Reduce the common impedance across which the feedback occurs.

(2) Reduce the gain of the i-f system.

As mentioned above, the Underwriters limit the value of the isolating condenser to 0.25-mfd. to reduce the shock hazard. If the chassis is well protected from contact, the capacity can be increased to some extent. However, due care should be exercised to see that the condenser is of good quality and rated at not less than 400 volts (working).

A more satisfactory method of eliminating such i-f oscillation is to increase the bias on the i-f amplifier until the gain of the tube is reduced enough to restore stability. When it is considered that most ac/dc receivers are of the very inexpensive type, and that the customers are usually not willing to pay any considerable sum for repair work (approaching ⅓ to ½ of the original cost) it is usually best practice to correct oscillation troubles by the fastest method —raising the bias—even though perhaps somewhat better results might possibly be obtained if more time were to be spent on the repair."

HOW TO "ALIGN" THE TUNED CIRCUITS OF SUPERHETERODYNE RECEIVERS

Routine Service Alignment of Superheterodyne Receivers

The procedure for performing routine service alignment on superheterodyne receivers has been explained in so many servicing magazines, test oscillator instruction manuals, and receiver manufacturer's service bulletins, that most radio service men understand it thoroughly. However, for the benefit of beginners in the art of service work, and for those who know all about *how* it should be done but who have developed careless habits in this important work, it will be reviewed here briefly.

It should be remembered that the idea of including this information here, is to present instruction for a standard basic alignment procedure that will be correct in most cases, but, as some receiver designs require special alignment procedure, variations from the system to be outlined here may be necessary on occasion. Therefore, if the factory service instructions for a receiver are at hand, they should be consulted for any special alignment instructions or precautions necessary for the receiver in question. These instructions have been prepared by the engineers who designed the receivers, and who are in an excellent position to know of any special difficulties attendant on proper operation and alignment of the receiver.

The Proper Sequence of Alignment Operations, and What Each is Intended to Accomplish

When a receiver is being aligned, either originally or whenever the original adjustments have been disturbed in some way, the purpose is properly to line up or "peak" the "resonance" settings of the various tuned r-f and i-f circuits at several important predetermined frequencies. The most satisfactory sequence for the aligning operation for a complete superheterodyne receiver (*unless the receiver manufacturer directs otherwise*) is usually:

(1) Make all "preliminary" preparations necessary for the Alignment Work.

(2) Since maximum output from the i-f amplifier will be obtained when it is adjusted to the exact frequency applied to it by the mixer, it is wise to align or *"peak"* the tuned circuits of each i-f amplifier stage correctly at the specific intermediate frequency (or several frequencies close to it), for which the i-f amplifier is designed. (It is in this work that the *I-F Peak Chart* presented in *Section 4* of this *Handbook* is extremely useful, since it lists the correct intermediate frequencies to which most of the i-f transformers likely to be encountered in this country are to be "peaked". If it is found that the i-f for any particular receiver is not listed, an explanation of the procedure to be followed in aligning an i-f transformer of unknown peak frequency will be found in the explanatory text just ahead of the *I-F Peak Chart.*)

(3) Next, the oscillator circuit should be adjusted at the high-frequency end of the dial (say at about 1,400 kc) so that it "tracks" properly with the r-f circuits at the high-frequency end of the dial (the oscillator frequency should always be *different* from the incoming signal frequency by an amount equal to the i-f used in the receiver under adjustment—regardless of the position of the receiver tuning dial). The dial should then be swung around to about the 600 kc position, and the oscillator circuit adjusted so that it "tracks" properly with the r-f circuits at the low-frequency end of the dial. When this oscillator "tracking" alignment is upset, the result is: (a) a fall in signal strength to as low as zero in extreme cases; (b) noisy reception; (c) poor selectivity resulting in adjacent stations interfering; (d) poor tone quality and distortion on deeply modulated passages.

(4) At the same time that the "tracking" of the oscillator is being adjusted, it is usually preferable also to align the tuned circuits of the r-f (pre-selector) stages properly with each other. This system has been adopted by most experienced service men to avoid waste of time and inaccurate alignment adjustments. (If a "double-spot" image-suppression circuit is employed in the receiver, its adjustment must be carried out in a special way.)

Proper Preliminary Preparations Necessary for Alignment Work

Many service men tackle radio receiver alignment in an off-hand and slap-dash way without any thought of *properly preparing the receiver for alignment.* The following preliminary ground work *must* first be done if correct alignment results are expected.

To prepare a receiver for alignment, it is first necessary to understand what the receiver circuits involve, i.e., whether the receiver includes *avc, afc, qavc, etc.* circuits. It is necessary to know the location of each stage, both physically and electrically, with respect to the preceding or succeeding stage. It is also necessary to know the locations of the various trimmer adjustment screws for the r-f, oscillator, and i-f tuned circuits. The radio receiver and test oscillator should be allowed to warm up for a period of at least 15 minutes so that all test oscillator and receiver components will reach their proper operating temperatures.

The procedure as outlined in this text is meant to be a *general guide,* to be supplemented by special instructions in the case of each receiver model, if they are available. It is well to determine in advance whether you do or do not have the actual set manufacturer's alignment procedure, and

if this is available, it should be studied and followed. Most set manufacturers now supply actual step-by-step procedure in their service bulletins (or it may often be found in set manuals), and this, coupled with the schematic circuit diagram and chassis layout sketch showing the location of the various adjustment controls, should provide ample help.

How to "Kill" the AVC Action when Aligning Receivers Provided with AVC

An important precaution must be observed when using an output indicator during the alignment of receivers which employ avc (all modern sets). With the avc functioning properly, as we approach the resonance point by alignment the output signal will *tend* to rise, causing the avc voltage to develop, which in turn will *reduce* the sensitivity of the receiver. Thus, over a considerable range of adjustment of the trimmers, the output will remain constant, and it is not possible to tell when the correct adjustment for exact resonance has been reached. Hence the action of the avc must be prevented while the alignment adjustments in the r-f, oscillator, and i-f circuits are being made. The best method to employ for preventing the avc from functioning depends a great deal on the particular avc arrangement used in the receiver. We will now study the various methods in popular use.

(1) In some receivers, the avc action is obtained by the use of a separate avc tube. This tube should *not* be removed from the receiver when making adjustments of any kind, for it will disturb the normal characteristics of the receiver. To use an output indicator with receivers of this kind, the lead which couples the signal to the control grid of the avc tube should be opened. This will allow practically the normal tube currents to flow, but at the same time prevent the avc action from taking place.

(2) Another expedient which may be resorted to is to use such a weak signal from the test oscillator that the avc action does not take place, i.e., the receiver is operated *below* the point of avc action. This latter method is especially recommended when aligning receivers which employ delayed avc circuits. However, this method is not practical with some receivers, for, when the input signal is made so weak, it is not possible to obtain a sufficiently large deflection of the output indicator to make accurate alignment possible.

(3) Still another method to prevent the avc action is to break the lead which picks off the avc voltage from the avc circuit and distributes this voltage to the avc-controlled tubes. The part of the lead which goes to the grid circuits of these controlled tubes should then be grounded directly to the chassis. This will place only the small residual bias on the tubes, which will raise the sensitivity of the receiver to maximum, necessitating a reduction in the test oscillator output. This latter method is of special value in receivers using a "combination tube" in which the second detector, avc and first-audio functions all take place. The 55, 75, 85, 2B7, 6B7, etc., types are typical examples of such tubes. Naturally it is not possible to disconnect the avc portion of such tube circuits without appreciably affecting the detector and first audio sections.

(4) In some receivers of the foregoing type which use a combination second detector, avc and first-audio tube, it may be inadvisable to operate the tubes which are normally under avc control, without proper grid bias voltage. In such cases, the normal fixed grid bias voltage may easily be supplied to these tubes by connecting a potentiometer of about 100,000 ohms directly across a 45-volt *B* battery. The positive terminal of the battery should be connected to the chassis of the receiver. No connection other than that of the potentiometer is made to the *negative* terminal of the battery. After the lead which picks off the avc voltage from the avc circuit and distributes it to the control-grid circuits of the avc-controlled tubes has been broken, the part of this lead which goes to the grid circuits of these controlled tubes should be connected directly to the movable arm of the foregoing potentiometer. The setting of this arm may be adjusted to provide the correct negative grid-bias voltage for the normal operation of these tubes during the alignment of the receiver.

After the avc action has been made ineffective by one of these means, the alignment of the receiver may be carried out exactly as it would be for receivers without avc.

How to Interrupt the Operation of Other Control Circuits

Next, it should be ascertained if the receiver contains an afc, or r-f noise suppressor circuit. If so, these should be interrupted temporarily in such a manner as to allow the normal d-c operating voltages to be fed the r-f and i-f tubes. If the receiver has an "AFC Manual" switch, it is merely necessary to place this switch in the "Manual" position in order to interrupt the afc circuit.

How to Interrupt the Operation of the Receiver Oscillator

Finally, before alignment of the i-f stages is attempted, the temporary interruption of the operation of the receiver oscillator should be accomplished. Two simple ways of doing this are:

(1) In some cases, "shorting" the oscillator section of the variable gang tuning condenser by connecting a short piece of wire between the stator and rotor plates will suffice.

(2) In other cases, where there is a d-c voltage present across these two points, it is best to substitute a 0.5-mfd. capacitor to eliminate the possibility of shorting out this circuit and burning out the oscillator coil. It really is good practice to use the 0.5-mfd. capacitor instead of a "shorting" wire in all cases, merely as a safety procedure. The capacitor should be connected between the stator of the oscillator tuning condenser and ground, or between the oscillator tube control-grid and ground.

Procedure for Aligning "Peaked" I-F Amplifiers

A good modulated r-f test oscillator provided with good attenuation control is essential, so that the level of the signals sent into the receiver can be reduced to a very low value if necessary. Second, an output meter or other receiver output indicating device (such as a v-t voltmeter, cathode-ray oscillograph, etc.,) should be employed.

(1) First make sure that all the tubes of the receiver are in their proper sockets, that all control-grid leads are properly connected, and that all shields are properly in place. The aerial wire should be disconnected from the receiver, but the ground wire (if one is used) should be left in place. Then, connect the shielded output cable of the test oscillator to the receiver, connecting the outer shield to the "Gnd" post of the receiver (or to the chassis if the chassis is grounded), and connecting the inner wire to the control-grid of the *first* detector or "mixer" tube. This is the best connection for the i-f amplifier alignment of most receivers. It is usually best to make this connection to the control grid and then put the control-grid clip and tube shield back in place. Now turn the test oscillator on (so it will have an opportunity to warm up and reach a steady operating state) and then set it to deliver the correct i-f for the receiver under adjustment (see chart of "I-F Peaks" in *Section 4* of this *Handbook*). The output indicator (whatever type is employed) should then be connected to the receiver in the proper way.

(2) Next, ascertain if the receiver contains an afc or r-f noise suppressor circuit. If so, these should be temporarily interrupted (as already explained) to allow only the normal d-c operating voltages to be fed to the r-f and i-f tubes. The operation of the receiver oscillator should also be interrupted (as already explained). The avc (if avc is incorporated in the receiver) should also be made ineffective by one of the methods already described. Now, turn the receiver on. If it has a "normal-maximum" switch, the switch should be placed in the "normal" position and the volume control should be set at the full "on" position. The test oscillator (being operated with its output signal modulated) should now be readjusted carefully to the correct i-f setting, and its attenuator control should be adjusted until the output indicator reads about one-half the full-scale deflection.

(3) The following i-f alignment procedure applies to receivers which employ i-f transformers, designed to be "peaked" at one frequency.

Locate the i-f transformer unit which is connected between the last i-f tube and the second detector tube. Its tuning condensers are to be adjusted first, starting with the condenser nearest the second detector in the circuit. An insulated screw driver or socket wrench (whichever is required) should be used for making the adjustments, inserting the proper tool in the holes provided for this purpose in the shield can. Special fibre or bakelite tools are available for this work. Turn the adjustment of the secondary tuning condenser of this i-f transformer slowly, until the output indicator deflection is greatest. If this unit is very much out of adjustment, it may be necessary (while the adjustments are being made) to reduce the test oscillator output by lowering the setting of its attenuator control from time to time so as to keep the output indicator deflection within the scale range. (Inability to "peak" an i-f transformer may be due to absence of "trimmer" capacity variation, even though the trimmer screw turns. This occurs when the trimmer has been turned down too tight, causing the plate to become permanently sprung. In such cases, it is best to replace the trimmer, or the entire i-f unit, with a new one.) Continue to turn the screw or nut until the output indicator deflection is greatest. Then adjust the primary tuning condenser on this same transformer until the output indicator deflection is greatest again. When this is finished, check the adjustment of the secondary condenser again, since, frequently the adjustment of the primary will change the adjustment of the secondary slightly. Repeat this for the primary condenser to make sure.

(4) If the receiver employs more than one i-f transformer unit, similar adjustments must be made on the tuning condensers of each one, progressing step by step *back toward the first detector*. In each case, first the secondary, and then the primary, tuning condenser is adjusted for highest reading on the output indicator. Usually, the attenuator control on the test oscillator will have to be lowered after each adjustment is completed, in order to keep the output indicator reading within its scale range.

(5) When aligning the i-f stages of some receivers, it may be found difficult to obtain a fine adjustment for the line-up of a particular stage when the test oscillator is coupled to the input of the entire i-f amplifier by connecting it as directed in part (1). In such cases, closer adjustment may be made by coupling the oscillator direct to the particular stage being aligned. For example, if the grid circuit tuning condenser of an i-f stage is being adjusted, the inside lead of the test oscillator shielded cable may be connected to the *plate* of the preceding tube. If the plate circuit condenser is being adjusted, the test oscillator lead may be connected to the control grid of this preceding tube. In all cases, the outside shield of the test oscillator cable should be connected to the "Gnd" post of the receiver and the tube shield should be tightly in place. The foregoing i-f alignment procedure is satisfactory only for receivers which employ i-f transformers designed to be "peaked" at one particular frequency.

Aligning Superheterodyne Receivers Having Badly Misaligned I-F Stages

Whenever a receiver having its i-f stages very far out of alignment is encountered, it is good practice to check the adjustments of the i-f stages several times after realigning. The reason for doing this is that a major adjustment of one tuning circuit may react by inductive effect on another tuning circuit which has already been adjusted, with the result that after the receiver has been completely aligned the first time, some of the circuits which were first adjusted will be found to be out of resonance. Therefore, in cases of bad misalignment, repeat the alignment procedure at least *twice* in order to make certain that all circuits are finally in correct alignment.

Procedure for Aligning Flat-Top (or Band-Pass) I-F Amplifiers

There are some receivers, especially those of the high-fidelity type, which employ i-f transformers designed to have resonance curves which are wide at the top instead of sharp, so that the side-bands will not be suppressed in the i-f amplifier to such a degree that the receiver will lack "highs." In most cases, the primary and secondary windings of these i-f transformers are closely coupled by being mounted close to each other, as distinguished from the more loosely coupled arrangements employed in the sharply-peaked transformers where the primary and secondary windings are spaced far apart or have a copper shield placed between them. The alignment of such i-f stages must be carried out carefully so that there will not be any serious cutting of side bands. These "flat-top" transformers are not supposed to be peaked at any single frequency, but rather to a band of frequencies about 4 or 5 kc on each side of the main i-f frequency in ordinary receivers having high selectivity, and about 7.5 kc on each side in high-fidelity receivers. For example, with a 10 kc *total* flat-top, if the main i-f is 460 kc, the flat-top band width of the resonance curve might extend from 460 — 5 to 460 + 5, i.e. from 455 to 465 kc. When receivers employing these i-f amplifiers are to be aligned, it is always best to consult carefully the manufacturer's instructions for the particular receiver under consideration, since special adjustments must often be made. If these instructions are not available, the following information may be found useful:

The receiver, test oscillator and output indicator should first be connected exactly as explained for *Aligning Peaked I-F Amplifiers*. There are two methods in use for aligning these flat-top transformers:

(1) In the first, the *secondary* is tuned near one of the flat-top frequency limits, and the *primary* is tuned near the other. For example, suppose the i-f amplifier is to be flat-topped from 455 to 465 kc. Starting at the i-f transformer nearest to the second detector (in the usual way), the secondary would be adjusted to produce highest output with the test oscillator feeding a signal of about 465 kc into the i-f amplifier. Then the primary would be adjusted to produce highest output with the test oscillator set to feed a signal of about 455 kc into the i-f amplifier. It would be best to check these adjustments at least *three* times to insure accurate setting. As a final check, the test oscillator dial would be rotated slowly to vary its frequency from 455 to 465 kc and the output indicator noted at the same time. The change in deflection of the output indicator should be just about as represented by the flat-top portion of a typical flat-top resonance curve, dropping slightly at the center region.

(2) Another method of aligning these flat-top transformers is first to adjust the secondary and primary to the peak (center) i-f, and then slightly detune each (detuning one *above* and one *below*) until the variation of the output indicator deflections (as the test oscillator frequency is varied over the desired flat-top range) is very slight. The important thing is that the change in deflection of the output indicator should be the same on either side of the center or *main* i-f.

Aligning the I-F Amplifiers of All-Wave, Short-Wave and Dual-Band Receivers

The general procedure for aligning the i-f stages of all-wave, short-wave and dual-band receivers is exactly the same as described here for the standard broadcast-band type receivers, except for the fact that the intermediate frequencies used in all-wave receivers usually range from about 450 to 470 kc instead of 175 or 260 kc as was commonly used in older type standard broadcast-band receivers. Of course, the alignment procedure for the r-f, oscillator, and mixer stages differs, but this will be considered later.

Aligning the Oscillator, Mixer, and R-F Circuits of Broadcast-Band Receivers

The alignment of the oscillator and r-f circuits in standard-broadcast band receivers will now be considered. The short-circuiting wire (or the 0.5-mfd. condenser) which was shunted across the receiver oscillator tuning condenser (or between ground and the control grid of the oscillator tube) in order to prevent the oscillator from operating while the i-f amplifier was being aligned should now be removed.

If the tracking between the receiver oscillator frequency and that of the r-f circuits, and also the alignment of the r-f amplifier and mixer circuit tuning condensers (which are ganged together), are to be checked and adjusted, the shielded output cable of the test oscillator should be connected to the *Ant.* and *Gnd.* posts of the receiver. The output indicator should also be connected properly to the receiver. The oscillator tube, as well as all other tubes, shields, control-grid leads, etc., should be in their proper places.

Directions for the alignment of superheterodyne receivers often specify that the r-f circuits, consisting of the r-f amplifier (pre-selector) and the mixer tuning condensers must be aligned last—after the oscillator tracking has been checked. However, for speed and directness in this work, it is best to align them with each other at the same time that the oscillator circuit is being adjusted. The trimmers on the r-f condensers may be adjusted for the high-frequency end of the dial at the same time that the oscillator high-frequency tracking trimmer (padder condenser) is being adjusted. In this way, both operations are performed at almost the same time.

(1) Adjusting the Oscillator for correct "tracking" at the High-Frequency end: First, set the test oscillator operating at 1,400 kc. This is the signal frequency at which the adjustable high-frequency tracking trimmer of the oscillator is commonly adjusted so that the ganged oscillator-tuning condenser will track properly with the r-f circuit tuning condensers at the high frequencies. The test oscillator signal should be tuned in by setting the dial of the receiver exactly to the 1,400-kc division. If the signal is not heard at this receiver dial setting, but *is* heard at an "off" point, say 1,300 kc, the receiver should be retuned by adjusting the other (pre-selector and "mixer") tuning condensers to produce maximum output at this "off" point setting of the receiver dial; then retuning the set nearer the 1,400-kc division and readjusting these r-f tuning circuit condensers there. This alternate process must be repeated, approaching closer to the 1,400-kc dial division each time, until the signal comes in at maximum strength when the receiver dial is set at the 1,400-kc division.

When the 1,400-kc signal from the test oscillator is finally brought in with maximum strength when the receiver dial is also set exactly at the 1,400-kc division, the high-frequency tracking trimmer of the receiver oscillator should be adjusted until the highest output indicator deflection is obtained.

(2) Aligning the R-F and Mixer tuned circuits at the High-Frequency end: The tuned circuits of the r-f (pre-selector) stages (if any are employed), and of the first detector or "mixer" stage may now be aligned with each other conveniently at the high-frequency end. With the test oscillator still connected and set at 1,400-kc, the trimmers on those sections of the gang tuning condensers which tune these r-f circuits should be adjusted for maximum output. The tuning dial should be "rocked" back and forth slightly about the 1,400-kc point while the adjustments are being made. If the plates of these condenser sections have been bent, they should be readjusted over the entire range of the broadcast band. This completes all the high-frequency adjustments to be made on the receiver.

(3) Adjusting the Oscillator for correct "tracking" at the Low-Frequency end: The low-frequency tracking padder of the receiver oscillator (if one is provided) should now be adjusted with both the test oscillator and the receiver tuned exactly to 600 kc. This condenser should be adjusted until the largest output indicator deflection is obtained. This adjustment should be made while the receiver dial is "rocked" slightly about its 600-kc position. The r-f circuit tuning condensers are not provided with low-frequency padders, but their split rotor plates can be bent carefully so as to make the output indicator deflection maximum. It is wise to re-check the high-frequency oscillator tracking adjustment at this point, for accurate results.

(4) Adjusting Receivers without A Padder for Low-Frequency tracking of the Oscillator: In a few commercial receivers, particularly of the midget type, a low-frequency oscillator-tracking padder is not provided. In such cases, the tuning dial of the receiver must be turned about the shaft (after loosening the set-screws) so that broadcast signals at the low-frequency end of the tuning range are received at the correct receiver dial settings. The high-frequency oscillator tracking trimmer is then adjusted so that when a 1,400-kc signal from the test oscillator is received, it produces maximum output, when the receiver tuning dial is set very close to the 1,400-kc point.

(5) Checking "Tracking" of the Oscillator over Middle of dial: Although no adjustment for correct tracking between the r-f and the oscillator circuits is made between 1,400 and 600 kc, some modern circuits automatically track exactly at 1,000 kc (because of the design of the padding circuits) if the tracking is correct at 600 kc and 1,400 kc. In such cases, the test oscillator should be adjusted to feed a 1,000 kc signal to the receiver, and the oscillator tracking should be checked at this point. If it is off at this frequency, it may be necessary to realign at 1,400 and 600 kc to make the 1,000-kc point check closely. Otherwise, it may be assumed that the oscillator frequency tracks above the signal frequency by an amount equal to the i-f of the receiver (or at least within a few kc of it), over the entire dial. Only in rare cases need the plates of the oscillator tuning condenser be bent to produce this condition.

Line-up Frequencies and Procedure for Aligning the Oscillator, Mixer, and R-F Circuits of All-Wave, Short-Wave and Dual-Band Receivers

The general method employed for aligning the various tuned circuits of all-wave, short-wave and dual-band receivers is sensibly the same as has already been explained here for single-band (broadcast-band) receivers —with the exception that the r-f, mixer and oscillator stages are adjusted on each of the r-f bands for which the receiver is designed.

There are definite frequencies at which the various tuned circuits of an all-wave receiver are aligned. Common frequencies at which alignment is performed are, 600 kc, 1,400 kc, 4,800 kc and 15,000 kc, and the i-f employed in the receiver. The 600- and 1,400-kc points are for the standard band, the 4,800-kc point is for the first short-wave band, the 15,000-kc point is for the second short-wave band, and there may or may not be a line-up point for the final band. The exact line-up frequencies for a given receiver must be obtained from manufacturer's data, as few receivers cover precisely the same frequency band for each position of the wave-band switch. Hence, for best performance, each receiver model should be lined up at the frequencies specified by the manufacturer.

Of course, the test oscillator used for aligning the receiver should cover the necessary frequency range with sufficient output; in some cases it is desirable also to measure the image response on the higher frequencies. For any alignment procedure or conditions different from those described here, the service bulletins of the receiver manufacturer should be consulted.

I-F ALIGNMENT "PEAKS" OF 20,816 SUPERHETERODYNE RECEIVERS*

IF best performance is to be obtained from a superheterodyne receiver, the adjustment of its i-f amplifier tuning circuits must always be such that they tune to the exact frequency (or narrow band of frequencies) intended by its designer. Unless these circuits are tuned exactly to the frequency of the signal that is fed to the intermediate amplifier, the signal strength and the performance of the receiver will suffer.

Why "I-F Peak" Values Must Be Known

If the i-f tuned circuits are thrown out of adjustment during shipment of the receiver, by the repair or replacement of windings on the i-f transformers (or the entire transformers themselves), or even during normal usage of the receiver, the service man must realign them.* Of course, when called upon to do this, it is extremely important for him to know exactly the proper intermediate frequencies (or narrow band of frequencies) at which the intermediate amplifier circuits are to be realigned.

It is the purpose of the following compilation of the Intermediate Peak Frequencies of all American and Canadian superheterodyne receivers manufactured up to this time to supply this information quickly to the service man when he finds i-f amplifier realignment necessary.

Accuracy & Reliability of "I-F Peak" Compilations

Many "i-f peak" compilations have been published in various books and servicing magazines since the original table of this kind appeared in the old First Edition *Radio Field Service Data* book (now out of print), by Alfred A. Ghirardi. The usefulness of most of these compilations as reference data sources in practical service work is questionable and definitely limited because of their incompleteness and the numerous serious errors they contain.

The compilation presented here represents a sincere effort to eliminate these important shortcomings. Although its preparation has entailed a great amount of work, it has been well worth it, for all of the data has been checked and rechecked against the records of all of the receiver manufacturers, and everything possible has been done to insure its accuracy. As a result, this listing should prove to be the most reliable and complete source of "i-f peaks" now available to radio service men.

How to find the "Peak" Intermediate Frequency of a Receiver for which no Published Data is Available

Occasionally a service man is faced with the problem of aligning a superheterodyne receiver for which the correct i-f peak is not known. In such instances it is possible to determine the correct (or approximately correct) i-f peak by making the following simple check with a test oscillator and suitable receiver output indicator:

The receiver to be aligned should first be placed in the best operating condition possible. Then the output indicator, if one is used, should be connected properly to the output circuit of the receiver. A modulated signal from the test oscillator should now be fed into the grid of either the first or the last i-f tube, and the oscillator section of the receiver tuning condenser should be "shorted out" to prevent harmonics from the test oscillator from feeding back into the r-f circuits of the receiver. The frequency of the test oscillator should then be varied *slowly* and *carefully* between about 550 kc and 100 kc, *starting at 550 kc* and slowly *reducing* the frequency until a signal is heard in the receiver loudspeaker or is shown by the output indicator. The frequency setting of the test oscillator at which the signal is heard (or indicated) is *probably* the i-f peak (although it *may* be a *harmonic* of the i-f peak).

A check should now be made to find out whether it is really the i-f peak or whether it is a *harmonic* of it. To do this, first set the test oscillator at *twice* the frequency found by the foregoing procedure. If no signal is heard (or indicated), then the original frequency-setting of the test oscillator is the i-f peak of the receiver. (Now, by setting the frequency of the test oscillator at *half* the determined peak, its *second harmonic* signal should be heard—or indicated—but not quite as strongly as before, which is further confirmation of the i-f peak.)

It is quite possible that the intermediate frequency determined by the foregoing procedure results in some *odd* frequency, such as 459 kc or 461 kc, etc. By consulting a compilation of intermediate frequencies, it can be seen that the nearest *commonly used* i-f to this is 460 kc. This latter frequency can therefore be assumed as the correct i-f of the receiver, since the i-f alignment of the receiver as it was brought into the shop may have been "out" by just one or two kc. (The resonance settings of i-f transformers seldom vary by more than one or two kilocycles from the specified correct i-f peak unless the trimmer adjusting screws have been tampered with.)

When making the foregoing test, it is possible that the matter of *adjacent* i-f peaks will arise. By this is meant that definite peaks will be observed at adjacent frequencies such as 175 kc and 177.5 kc, 260 kc and 262 kc, etc. How is one to determine which of the two adjacent intermediate frequencies is the correct receiver i-f? In almost every instance it will be found that the i-f transformers will peak more readily at one of these frequencies without the necessity of tightening down (or entirely loosening) the trimmer condenser adjustments. In other words, should the foregoing i-f peak check-up reveal definite peaks, say, at both 260 kc and 262 kc, and should it then be found that the "trimmers" must be tightened down considerably to align the i-f amplifier correctly at 260 kc, then by this reasoning 262 kc would probably be the correct receiver i-f.*

(Cont'd)

*Note: For information regarding the exact procedure to follow in performing *Routine Service Alignment* on superheterodyne receivers, see *Section 3* of this *Handbook*.

Arrangement of Data in this "I-F Peak" Compilation

Following is the compilation of the various peak intermediate frequencies employed in all commercial superheterodynes manufactured up to the present time. The groups are arranged *alphabetically* according to manufacturers' or trade names; the receivers in each manufacturer's group are listed *alphabetically* and *numerically* according to model numbers.

Addresses of Receiver Manufacturers

For a complete compilation of the names and addresses of all receiver manufacturers, as well as the *Trade* (or *Brand*) *Names* of the receivers they manufacture, see the *"Directory of Radio, Television, and Facsimile Receiver Manufacturers and Receiver Names."* It will be found near the back of this *Handbook*.

***NOTE:** For a comprehensive presentation of the principles involved, and the actual step-by-step procedure to employ in the alignment of all types of superheterodyne receivers, see *Section No. 3* of this *Handbook*, and the Chapters on *"Aligning Superheterodyne Receivers"* in the book *Modern Radio Servicing*, by *Alfred A. Ghirardi*. The use of the Cathode Ray Oscillograph in all alignment and other service work is also explained in this book. *Modern Radio Servicing* is published by *Radio & Technical Division, Murray Hill Books, Inc.*, 232 Madison Ave., New York 16, N. Y. (descriptive circular will be supplied *free* upon request).

ACE
(See Radio Circular Co.)

ACRATONE
(Federated Purchaser, Inc.)

Model	kc
5B	456
6A	175
6B	456
7A	465
7B	456
7C (Late)	456
7C (Early)	456
8A	465
8B	456
9B, 11B	456
12A	175
12B	456
13A	465
13B	456
14A	175
14B, 16B	456
17	175
17B, 18B, 19B	456
20B, 21B, 22B, 23B	456
24A	465
24B	456
26C, 27C, 28C, 29C	456
30C	456
31-40	175
31C	456
32A	175
32C, 33C, 34C	456
36A	175
38A	456
39A	485
40	175
40D, 40DLW	460
42, 42D	175
43	260
43A	485
43D	175
44, 44A	485
44D	175
49, 51, 52A	175
52F, 52G, 53D, 54D	456
55D, 56D, 58D	456
60E	460
61E, 61G	456
62E, 62G	175
64F, 64J	456
65	455
65F	456
66	455
66F	456
67F, 67G	456
68A	460
68F, 68G, 69F	456

(Cont'd)

ACRATONE—*(Cont'd)*

Model	kc
73H, 73J	460
75H, 75J	456
76H	460
77	456
79	175
79H, 79J	456
80	175
81H, 81J, 82H, 82J	460
83	456
83H	465
84H	456
86	485
86H	456
87	485
88	455
88H	456
89H, 89J	175
90H, 90J	175
92	175
93, 94, 96	370
96H	460
97	370
97H	460
101H, 103, 103H	456
104	465
104H, 107G, 107H	456
108J	456
111G, 112G	456
113J	456
115J	460
116J	465
117	465
117J	456
121	456
130K, 132, 134, 134G	456
137K, 138K	456
141, 143, 144	456
146B, 149	456
150	175
151, 152, 153, 154	456
156K, 157	456
158, 163, 167B, 167D	456
168B, 168D, 168G	456
169B, 169D, 169G, 169K	456
171K, 177B, 178, 179B	456
181K, 183, 184	456
186, 187, 188	456
189, 190	456
190K, 190M	175
191, 191K, 192K, 193	456
201K, 201L	456
202K, 202L	456
203K, 203L	456
204K	456
205K	465
205M	465

(Cont'd)

ACRATONE—*(Cont'd)*

Model	kc
206K, 207K	456
208K	456
209K, 210K, 211K	456
212K, 213K, 214K	456
216K, 217K, 219L, 219M	456
221L, 221M	456
224L, 225L	456
225M	456
226	456
226M	465
227M, 228, 229	456
230M, 231M	465
232M, 233M, 235M, 236M	456
237M, 238M, 241M, 242M	456
243M, 244M, 245M, 246M	456
247A-M, 247M	465
248	175
252M, 253M, 254M, 255M	456
259B, 260B	175
266B, 266F, 266G	456
267B, 267F, 267G	456
268G	456
296B, 297B	456
322, 324, 336B	456
337B, 338B, 339B	456
381, 383	456
648	456
651	456
824	456
834	456
844	456
1940	456

*

ADMIRAL
(See Continental Radio & Telev. Corp.)

AERO-CHARLES HOODWIN
(See Hoodwin Co., Charles)

AERONAUTIC
(See Mission Bell Radio Mfg. Co.)

AETNA
(See Walgreen Co.)

**Space has been left after the listings for each manufacturer so that the list of additional new receivers may be entered as they are announced.*

AIR-CASTLE
(See Radio Products Corp.)
(also see Spiegel, Inc.)

AIR-KING, ATLAS
(Air-King Products Co.)

Model	kc
Atlas	456
Autocrat	456
Council	456
Knave	456
Palace, Pirate	456
Premier	456
Regent	456
Road King	175
Royalty	456
5 Tube Super AC-DC Set, X825	456
X925, X934	455
X937, X942	455
6E	456
6FD, 6FF	456
6LW	175
7B, 7LW	175
7T-BC Super	175
9E, 9EC	456
11F	456
27, 28	456
32, 33	456
37, 39	456
47M, 48	456
52, 54	456
57, 58	456
60, 60A	456
66, 67, 68	456
70, 72, 73	456
74, 75, 76, 77	456
221, 222, 223	456
227, 228, 229	456
250, 250-B	456
251	456
252	455
255	456
257	455
260, 261	456
273, 274	456
373, 374	456
400	175
403I	456
500	175
501 Queen	456
503 Earl	456
505 Castle	456
508, 528, 595	456
600, 616, 666	456
704	455
710, 711, 712	456
715	456
720, 720A	456
721, 721A	456
722, 723	456
725, 725A	456
730, 731	456
770, 771, 787	456
810, 812, 815	456
820	456
822, 822X, 823	456
824, 825X, 826X	456
828, 832, 833, 834	456
837, X837, X837S	456
838, 850	456
870, 871, 884	456
909	455
910 (Early model—manufactured only up through Jan. 15, 1938)	456
911	456
912, 914	456
915	456
920	456

(Cont'd)

AIR-KING, ATLAS—(Cont'd)

Model	kc
980	456
3360	456
3905, 3906, 3910	455
3912, 3916, 3950	455
3980, 4000, 4000A	455
4001, 4002, 4007	455
4012, 4100, 4200	455
5000, X8312	455

AIRLINE
(Montgomery Ward & Co.)

Model	kc
Airline Series 1355 &1955	262
Auto Radio	262
OE (chassis for models 311, 411)	456
OF (chassis for models 310, 410)	456
O80, O90	175
04WG-464A	456
04WG-468	456
04WG-568	456
04WG-569C	456
04WG-610	456
04WG-611	456
04WG-612	456
04WG-614	456
04WG-619	456
04WG-621	456
04WG-621NI	456
04WG-622A	456
04WG-623A	456
04WG-672B	456
04WG-673	456
04WG-674	456
04WG-725	456
04WG-727	456
04WG-728	456
04WG-731B	456
04WG-803	456
04WG-803B	456
04WG-1108A	456
1, 2	175
2D (chassis for model 293)	456
5Y1 (chassis for model 199)	175
6D (chassis for model 229)	175
6G (chassis for model 326)	465
6L (chassis for model 238)	175
7	175
7GM, 7L (chassis for models 226 & 228)	456
7P (chassis for model 332)	456
7Q (chassis for model 327)	456
8, 9, 11, 12	175
13	262
14, 15Y1 (chassis for model 199)	175
16	175
16X	262
17	175
18, 18-X	262
19, 19-X, 20, 20-X	175
21, 22	262
23, 24, 25	175
26	262
27, 29	175
30	262
31, 31-X, 33	175
34, 34-X	262
35	175
36, 36-X	262
37	175
38	262

(Cont'd)

AIRLINE—(Cont'd)

Model	kc
39	175
40	262
41	175
42, 43, 44, 44-X	262
45	455
46	262
46K1 (chassis for model 258)	175
46L1 (chassis for model 236)	175
46-X	262
47	455
48, 48-X, 49, 50	262
51, 52, 53, 54, 55	175
57	262
58, 58-X, 60, 61	175
62	262
62PC55	465
62PC64	175
62-258, 62-263 (auto radios)	175
62-274, 62-280	465
62-282	465
62-284	465
62-288, 62-290	465
62-292, 62-294	456
62-302, 62-304	456
62-312, 62-322	456
62-323, 62-324	465
62-325	456
62-350	465
62-353	465
62-361, 62-362	465
62-370	456
62-373, 62-374	456
62-377	456
62-380	465
62-387	456
62-390	465
62-401, 62-403	456
62-422	456
62-435	465
62-442, 62-452	456
62-453, 62-459	465
62-470	456
62-473	465
62-490	465
62-501, 62-502	465
62-504, 62-505	465
62-550	465
62-551, 62-552	465
62-553, 62-558	465
62-601	465
62-650	456
62-651, 62-652	465
62-654, 62-655	465
62-656	465
62-701	465
62-702, 62-703	465
62-750, 62-751	465
62-900	465
62-1550	465
62-1551, 62-1558	465
62-1654, 62-1655	465
62-1656	465
62-2550	465
62-2551, 62-2558	465
62-2654, 62-2655	465
62-2656	465
64, 66, 67	175
68, 68-X, 69	262
70, 70-X	455
71	175
72, 72-X	455
73, 74, 74-X, 75, 76, 76-X, 77	175
78, 79	262
80	175

(Cont'd over)

AIRLINE—*(Cont'd)*

Model	kc
81, 81-X	455
82, 83	175
84, 86, 87, 88	262
89	175
90	455
91	175
92	262
93	175
94	262
95	175
96	262
97, 97-X, 98, 99, 99-X	262
101, 101-X	262
102 (auto radio)	175
103	175
104	262
105, 106, 107	175
114	175
115	456
116	175
117	262
118 (auto radio)	262
119, 120, 121, 122	175
123, 124	456
125, 126, 127, 128	175
129	456
130 (auto radio)	175
131	456
132, 133, 134, 134-X	456
135	370
136	175
137	456
138	175
139, 139-X	456
140, 140-X, 141	175
142	456
143	175
144, 145, 146	456
147, 147-A, 147-B	370
147-C	465
148, 148-X, 149	175
150	370
151	175
152, 153	456
154	370
155	175
156, 156-A, 156-B	370
156-C	465
157	175
158	456
159, 160, 161, 162	175
163	456
164, 164-A, 164-B	370
164-C	465
165	456
166 (auto radio)	175
167	456
169, 171	465
173, 175, 176, 177	456
178	175
179, 180	456
181	175
182	456
183	175
185, 186, 187, 188	456
189	175
190	456
191	175
192, 193, 194	456
195, 196, 197	456
198	465
199 (chassis 5Y1 & 15Y1)	175
200, 202 (auto radios)	175
203	456
204 (auto radio)	175
205, 206	456
207, 208, 209	456
211	175
212	456

(Cont'd)

AIRLINE—*(Cont'd)*

Model	kc
213	175
214	465
215, 216, 217, 218	456
219, 220, 221	456
223	456
224, 225	465
226 (chassis 7L), 227, 228 (chassis 7L)	456
229 (chassis 6D)	175
230 (chassis 522), 233, 235	465
236 (chassis 6L & 46L1) (auto radio)	175
237, 239	175
240 (chassis 522)	465
241	456
242 (auto radio)	175
244, 245, 247	456
248, 249, 251 (chassis 822)	465
253	465
254	456
255 (chassis 822)	465
256 (auto radio)	465
258 (chassis 46K1) (auto radio)	175
259, 261	456
263 (auto radio)	175
264, 267	456
271, 273	456
274, 276	465
277	456
280, 282	465
283	456
284, 288, 290	465
292	456
293 (chassis 2D)	456
294	456
297	456
300, 301, 301X	465
302, 303, 304	456
305, 306, 307 (chassis 786)	465
308, 309, 310 (chassis OF)	456
311 (chassis OE), 312, 313	456
314	456
315 (chassis 586), 316, 317	465
318	456
319	465
320, 321, 322	456
323, 324	465
325	456
326 (chassis 6G)	465
326, 327	456
328, 330	465
331, 332 (chassis 7P)	456
333	456
334 (auto radio)	456
336, 337	456
338	465
339	456
340, 341	465
342, 343, 344	456
345, 346	465
347, 348, 349	456
350, 351, 352, 353	465
354, 355, 356	465
357	456
358, 359	456
361, 362	465
363	456
364	465
364 (auto radio)	175
365	465
367	456
368	456
369	175
370	456
371	465
372, 373, 374	456
375, 376	465

(Cont'd)

AIRLINE—*(Cont'd)*

Model	kc
377	456
380, 385	465
386	465
387, 388	456
390	456
396	465
401, 402, 403	456
404	456
405, 406, 407 (chassis 786)	465
408	456
409	465
410 (chassis OF), 411 (chassis OE), 412, 413	456
414, 415 (chassis 586), 416	465
417, 418	456
419	465
422	456
425 (chassis 515)	465
426	456
427	456
428	465
429	456
430	465
432, 433	456
434, 435	465
436	456
437, 439, 441, 442	456
445, 446	465
447, 448, 449	456
451, 452	456
453, 455, 456	465
457, 458, 459	456
463	456
465, 466	465
467	456
470, 471, 472	456
473	465
475, 476	465
477, 479	456
486	465
487, 488	456
490	456
494, 495	465
497	456
500, 501, 502	465
504, 505, 506	465
507	465
513	465
515 (chassis for model 425)	465
516	465
517	465
522 (chassis for models 230, 240)	465
536, 546	465
550, 551, 552, 553	465
554, 555	456
556	465
557	456
558	465
600, 601	465
606	465
607	456
616	465
617	456
636	465
646	465
650	456
651, 652	465
654, 655	465
656	465
670	175
700	456
701 (Early)	465
701 (Late)	465
702, 703	465
704, 705, 706, 707	456

(Cont'd)

AIRLINE—*(Cont'd)*

Model	kc
708, 709, 710, 711	456
712	456
750, 751	465
752, 753	456
786 (chassis for Models 307, 407)	465
811 (1711)	175
822 (chassis for Models 251, 255)	465
900	465
901, 902, 903	456
905, 910	456
1040	175
1100	456
1101, 1102, 1110	456
1111 (1611)	175
1238 (1838)	262
1355 (1955)	262
1453, 1454	465
1550, 1551	465
1558	465
1654, 1655, 1656	465
2550, 2551	465
2555, 2557	456
2558	465
2654, 2655	465
2656	465
93BR-335A	465
93BR-391A	465
93BR-392A	465
93BR-393A	465
93BR-420A	465
93BR-420B	465
93BR-421A	465
93BR-421B	465
93BR-423B	465
93BR-424B	465
93BR-431B	465
93BR-454A	465
93BR-455A	465
93BR-460A	465
93BR-461A	465
93BR-462A	465
93BR-508A	465
93BR-509A	465
93BR-560A	465
93BR-561A	465
93BR-562A	465
93BR-563A	465
93BR-564A	465
93BR-602A	465
93BR-603A	465
93BR-657A	465
93BR-658A	465
93BR-659A	465
93BR-660A	465
93BR-661A	465
93BR-713A	465
93BR-714A	465
93BR-714B	465
93BR-715A	465
93BR-715B	465
93BR-716A	465
93BR-717A	465
93BR-719A	465
93BR-720A	465
93BR-1201A	465
93BR-1455A	465
93BR-1460A	465

AIR MASTER
(See Automatic Radio Mfg Co., Inc.)

AIR RAIDER
(See Dunn-Hall)

ALL-AMERICAN MOHAWK CORP.
(Also see listings under Wurlitzer & Co.)

Model	kc
B-80	175
DC-7 (110V), DC-7 (220V)	175
DC65 (110V), DC65 (220V)	175
S-6, S-7	175
S-8, S-10	175
S-40, S-50	175
S-60, S-61, S-62, S-63	175
S-65, S-80	175
SA-51, SA-65	175
SA-90, SA-91	175
SA-110, SA-130	175
SW-8, SW-80	485
U-50, U-55	485
U-500, U-650	456

ALLIED RADIO CORP.
(See listings under Knight)

ALONSON
(See Commonwealth Radio Mfg. Co.)

AMERICAN BOSCH
(See Bosch)

AMERICAN FOUNDATION FOR THE BLIND, INC.

Model	kc
U	175
30	175

AMERICAN TELEV. & RADIO CO.

Model	kc
Duo	175
61	175

AMRAD
(Amrad Corporation)

Model	kc
F516	450
F546	450
F616	450
F626	450

ANDREA RADIO
(Andrea Radio Corp.)

Model	kc
CA5	470
PA7L, PA7S	470
1A5, 1A7	470
1B6, 1B8	470
1C5	470
1D6, 1D7, 1D8	470
1D10	470
1E6, 1E8	470
2A5, 2A7	470
2B6, 2B8	470
2C5	470
2D5, 2D6, 2D7	470
2D8, 2D10	470
2E6, 2E8	470
3A7	470
3B6, 3B6A	470
3B8	470
3B11, 3B13	470
3D5	470
3D7, 3D8	470
3D10	470
3E6, 3E8	470
3E11	470
4A7	470
4B6, 4B6A	470
4B8	470
4B11, 4B13	470
4D5, 4D7	470
4D8, 4D10	470
4E6, 4E8	470
4E11	470
5A5	470
5B8	470
5B13	470
5D7, 5D8	470
5D10	470
5E6, 5E8	470
5E11	470
6A5	470
6B8	470
6B13	470
6D5	470
6D7, 6D8	470
6D10	470
6E6, 6E8	470
6E11	470
7B8	470
7B13	470
7D5	470
7D7, 7D8	470
7D10	470
7E8	470
7E11	470
8B8	470
8B13	470
8D5	470
8D7, 8D8	470
8D10	470
8E8	470
8E11	470
9D10	470
9E8	470
9E11	470
10D10	470
10E8	470
10E11	470
11E6	470
12E6	470
14E6	470
62PX, 62X	470
400, 401	470
500, 500A	470
501, 501A	470
510, 511	470
520, 521	470
534, 535	470
600	470
605, 606 (auto radios)	175

(Cont'd over)

ANDREA RADIO—*(Cont'd)*

Model	kc
610 (6V. farm radios)	470
611 (32V. farm radio)	470
612 (6V. farm radio)	470
613 (32V. farm radio)	470
614 (6V. farm radio)	470
615 (32V. farm radio)	470
616, 617 (6V. farm radios)	470
618, 619 (6V. farm radios)	470
620, 621	470
626, 627 (6V. farm radios)	470
628 (6V. farm radio)	470
630, 631	470
632, 633	470
634, 635	470
700 (auto radio)	175
716, 717 (32V. farm radios)	470
718, 719 (32V. farm radios)	470
726, 727 (32V. farm radios)	470
728 (32V. farm radio)	470
1401, 1402, 1403, 1404	470
1405, 1406, 1407	470
1408, 1409, 1410	470
1530, 1531	470
1532	470
1533, 1534	470
1535, 1536	470
1537, 1538	470

ANSLEY RADIO CORP.
(Dynaphone)

Model	kc
Aylesbury	456
Coventry	456
Whitby	456
A-17	4300
A-21	4300
A-25	4300
B-1	456
D-3, D-4	175
D-6	175
D-7	456
D-9, D-10, D-14	456
D-17, D-18	456
D-21, D-22	456
D-23	456
D-24, D-25	456
D-26, D-27	456
FM-4 (Chassis)	4300
U-3, U-8	175
U-10, U-11	456

APEX
(See U. S. Radio & Telev. Co.)

ARCADIA
(See Wells-Gardner)

ARKAY
(R. K. Radio Labs., Inc.)

Model	kc
RK60G	175
RK60L	115
RKS-5	175
50, 60, 60-D	175
501	465
510	465
521, 522, 523	465
534	465
600	175

(Cont'd)

ARKAY—*(Cont'd)*

Model	kc
610	465
631	465
633, 634, 635	465

ARVIN
(Noblitt-Sparks Industries, Inc.)

Model	kc
5 (auto radio)	455
6 (auto radio)	455
7	170
7A	455
8A	455
9A	170
10-A (auto radio)	175
15, 16, 17 (auto radio), 17A	175
17B, 17C	170
18 (auto radio)	175
18FW	170
19 (auto radio)	170
20-A (auto radio)	181.5
20-B	175
22A (auto radio)	170
25, 27 (auto radio)	175
28 (auto radio)	170
28DM	170
29 (auto radio)	170
30-A (auto radio)	181.5
32 (auto radio)	170
33 (auto radio)	175
33DM	170
35, 37 (auto radios), 38	175
39 (auto radio)	170
41 (auto radio)	456
42 (auto radio)	170
44C	170
45	175
51 (auto radio), 51B	456
58, 58A	455
61	456
61B	456
61M, 62 (auto radio)	456
62B	175
62M	456
68, 68X	455
71	455
78, 78X	455
81, 81M	456
88	455
89, 91, 92	455
417, 467	456
502, 502A	455
507	456
510	455
517, 517B	456
518, 518A	455
518B	455
518DW	455
527, 527B	456
528CS	455
568, 568A	455
568DW	455
578B	456
602, 602A	455
608	455
617 (auto radio), 617B	456
618, 618A	455
618B	456
627, 627B	456
628	455
628B	456
628-CS	455
638, 638B, 638CS	455
702, 710	455
802, 803	455

(Cont'd)

ARVIN—*(Cont'd)*

Model	kc
818	455
818AT	455
828	455
828A, 828AT	455
838AT, 838CS, 848CS	455
927, 1127	456
1237	365 and 100
1237D, 1237X	455
1247	365 and 100
1247A, 1247D, 1247X	455
1427	365 and 100

ATLAS
(See listings under Air-King)

ATWATER KENT
(Atwater Kent Mfg. Co.)

Model	kc
E145	125
E412, E412X	472.5
E608, E608X	472.5
E648, E648X	472.5
E765, E765X	472.5
H-1, H-2	130
P216, P216X	472.5
P336, P336X	472.5
P412, P412X	472.5
P755, P755X	264
P810, P810X	472.5
P875, P875X	264
72, 72-H	130
80, 80-F	130
82, 83 (all)	130
84, 85 (all)	130
86, 87 (all)	130
88	130
89, 90 (all)	130
91 (auto radio)	260
91B (auto radio)	260
91C (auto radio)	260
92 (all)	130
93	1,000
94, 96, 99 (all)	130
112, 112-N, 112-S	472.5
126 (auto radio)	264
135, 135-Z	264
136 (auto radio)	264
137	125
145	264
E145, E145X	125
146	264
155	262.5
165 (early)	262.5
165-Q (1656 late)	264
168	125
184, 184-X	450
185, 185-A	264
188 (all)	130
200	472.5
206	472.5
206D, E206, E206X	472.5
206.0	472.5
E208, E208X	472.5
215, 215-E, 215-Z	264
P216, P216X	472.5
217, 217-B, 217-D	264
225	450
228 (all)	130

(Cont'd)

ATWATER-KENT—*(Cont'd)*

Model	kc
236	125
237-Q	472.5
246	262.5
E248, E248X	472.5
255	450
257	125
260 (all)	130
266	262.5
275	264
285-Q	450
286	472.5
305-Z	264
E308	472.5
310, 310-J, 310-T	130
312, E312	472.5
317	472.5
318, 318-K, 318-N	472.5
325, 325-E	264
328, 328X	472.5
P336, 337, 349	472.5
356	472.5
376	472.5
376-D, 376-DE	472.5
376-E, 376-KX	472.5
385-Q	264
387	264
412, E412, E412X	472.5
P412, P412X	472.5
415-Q	450
416 (auto radio), 416-G	264
424 (auto radio), 425	264
427, 427-D, 427-Q	264
435	450
446 (auto radio)	264
447	472.5
448	130
456	264
465-Q	264
467-Q	472.5
469 (all)	130
475	264
480	472.5
485-Q	450 or 472.5*
487	472.5
509 (Tune-O-Matic)	472.5
510	130
511, 511-W	472.5
515-Q	450 or 472.5*
525, 525-Q	264
534	450
545, 545-X	450
555	262.5
556 (auto radio)	264
558, 558-D, 558-Q	130
559, 559-N, 559-S	472.5
565-Z	264
567 (all)	130
585-Z	264
E608, E608X	472.5
612	130
625-Q	264
626	262.5
627	130
636 (auto radio)	262.5
637	472.5
648, 648E	472.5
649, 649-RP	472.5
655-Q, 655-QE	264
657-Q	472.5
665, 666 (auto radio)	264
667, 667-D	264
676	264
708, 710	472.5
711, 711-J, 711-R, 711-T	472.5
717	472.5
725, 725X	450
P725, P725X	450
735	264
747-Q	472.5

(Cont'd)

ATWATER KENT—*(Cont'd)*

Model	kc
756, 756-B (auto radios)	262.5
E765, E765X	472.5
768-Q	472.5
776 (auto radio)	264
788, 788-J, or T, 788-R	472.5
808, 808-A	472.5
810	472.5
812	130
816 (auto radio)	264
825 (AC-DC)	264
856	264
E865	472.5
P875, P875X	264
926 (auto radio), 936	264
944	450
976	264
978-A, 978-Q, 978-QK	472.5

* Look for label on rear of chassis for correct i-f. If label is not there, set the test oscillator at each of these frequencies in turn. The one which results in the greater receiver output will be the correct i-f.

AUBURN AUTOMOBILE CO.
(See **United Motors Service.** Also see **Auburn Models** listed under **Philco Radio & Television Corp.**)

Model	kc
A-1413, A-1414	260

AUDIOLA
(Audiola Radio Co.)
(Also see listings under Fairbanks Morse)

Model	kc
7 Tube Super Pent., '31	177.5
8 Tube Super Pent., '31	177.5
9 Tube Super Pent., '31	177.5
9 Tube Pent., '31	175
10 Tube Super	177.5
1931 Super	175
A-6, B-6, B-7	177.5
S-5, S-6, S-7	177.5
6, 7, 7-T	177.5
9-T-45	177.5
10-T	177.5
13-S-6, 13-S-9	177.5
23-S-7, 23-S-8, 23-S-8Q	177.5
23-S-10, 23-S-12	177.5
23-T-8-LW	177.5
31 Super	175
31Sh, 32-S-8-Q, 32-S-11	177.5
33-A-6 (auto radio)	177.5
33-S-5	456
33-S-5 (Rev.)	456
33-S-6 (auto radio)	177.5
33-S-6-B	456
33-S-7	456
33-S-8	456
33-S-8 (32 volts)	177.5

(Cont'd)

AUDIOLA—*(Cont'd)*

Model	kc
33-S-10-SW, 33-T-4	456
34-C-5 (AC-DC)	456
34-S-5 (AVC)	456
34-S-5-LW	456
34-S-10	456
50, 51, 52, 53	456
62, 72, 82, 83	177.5
146, 346, 347	177.5
516 (2V. batt. set), 523	177.5
710, 810	177.5
816 (32-Volt)	177.5
914, 2535	177.5

AUSTIN

Model	kc
S, SP	175

AUTOCRAT
(Autocrat Radio Co.)

Model	kc
Dictator 5	456
BA41	456
4	175
5BL, 5SA	456
6, 6D32	175
16ACS	456
23, 24	175
25ACL, 26ACL	456
29, 31	456
51VL	456
61VL, 66VS	456
90SL	175
92, 93	455
94, 95	455
96, 98	455
101	456
101-I, 101-O, 101-W	455
102-I, 102-O, 102-W	455
103-I, 103-O, 103-W	455
105	455
106	455
107-I, 107-W	455
109, 110	455
112, 113, 114	455
115, 116, 118	455
119, 120, 121	455
123, 125, 130	455
148	455
152	455
168	455
260VL	456
323	175
359	456
505	456
518	456
530	456
618	175
661VS	456
900, 910	175

AUTOMASTER
(See Automatic Radio Mfg. Co., Inc.)

AUTOMATIC RADIO MFG. CO., INC.
(Automatic, Air Master, Automaster, Autorola, Tom Thumb)

Model	kc
Sr. Auto	175
AC5, AC52	480
A1, A5 (auto radio), A6G	480
A60, A63, A74	480
B30 (AC-DC) Series I	456
B30 (AC-DC) Series II	456
B35, B40, B70	456
B80 (AC-DC)	456
B80LW, B85	456
C30, C40, C50	456
C60, C70, C80	456
E6	456
F10	480
J50, J60, J70	480
J80 (auto radio)	456
M10, M20 (auto radios)	456
M30 (auto radio)	456
M60 (auto radio), M66	456
M67	456
M70, M80 (auto radios)	456
P6, P43, P45	456
P57, P58, P61	456
P70, P72	456
R6, R61, R62	456
S6	456
402, 403, 404	456
405, 406, 408	456
420, 430, 432	456
434A, 436	456
440, 441, 442	456
443, 444, 445	456
446	456
448, 450, 452	456
454	456
480	480
830, 840, 845	456
850, 855, 860	456
862, 864, 865	456
866, 872, 874	456
878, 890, 892	456
915, 920	456
950 Tom Thumb	456
955 Tom Thumb	456
960, 960A, 963	456
970, 975	456
979, 988	456

AUTOPHONE
(See Cavalier Motors Associates, Ltd.)

AUTOROLA
(See Automatic Radio Mfg. Co., Inc.)

AUTO-VOX
(Auto-Vox Radio Co.)

Model	kc
75	175
80	262
85	262

BALKEIT
(Balkeit Radio Corp.)
(Fansteel)

Model	kc
G16A, G18A	456
G19B, G20	456
G200-X	456
GT16A, GT20	456
GT33	456
GT156BA	456
GT200-X	456
G18A, G19B	456
GT20, GT133	456
GT156BA	456
GT164	456
GT200X	456
L5, L6	456
L7 ('31)	175
L7 ('36)	456
L8	175
ML1, ML2	456
Z4, Z5	456
6-7	456
41A	456
55	175
59, 60, 69	456
70, 70A, 85	175
100	456

BAND-BOX
(See Crosley)

BARKER BROS.

Model	kc
L	262
M	262
P	262

BELMONT
(Belmont Radio Corp.)

Model	kc
50B Series	175
50C Series	175
60 Series	175
70 Series	175
100	175
110	175
274, 280	465
305, 306, 345	465
346, 350, 356	465
361, 362, 372	465
403, 404, 407	465
408, 411	465
415 Series A & B, 415-19	465
415-42, 435, 489	465
418, 460, 500B	465
501, 504, 505	465
507, 510, 511	465
513, 516, 517	465
519, 520	465
521, 522, 522C	465
523, 523B, 523-28, 523-42	465
524, 524A	465
525	456
526, 527	465
529	465
530	456
531	470
539	465
540, 541	456
544, 545	465
550	456

(Cont'd)

BELMONT—*(Cont'd)*

Model	kc
551, 551B, 553	465
555, 556	465
566, 567, 571	465
575	175
577 (auto radio)	465
577, 577C, 577D	465
578	465
580	175
582, 582B, 583	465
585 A, B	370
585 C, D	465
586, 586A	465
587, 588, 589	465
600	175
601 A, B, C,	465
602	465
602-B, 602-C	470
605 AC-DC	465
606 AC-DC	465
611	465
625	175
629	465
632, 633, 634	470
635, 636, 637	465
640	370
650	175
655	465
660	175
661 (auto radio)	465
665, 666 (auto radio)	465
667 (auto radio)	262.5
668	465
670, 670A	175
675, 675-E	370
661 (auto radio)	465
677A	465
677B	465
677C, 678A	465
680 (auto radio)	175
684 AC-DC	465
685, 685A and B	465
686, 686A and B	465
688	465
690 (auto radio)	175
691	465
701, 706, 707	465
708, 714	465
740 Series A	465
741 Series A	465
746, 746A	465
750	175
751	465
755, 761 (auto radio)	465
765	465
767	465
770	465
775	370
777 A, B, C	465
778, 778A and B	465
786, 786A, 787	465
791, 792	465
804, 804-41	465
822	465
823	465
840	465
842	465
845, 845 Series A	465
848, 849	465
855, 856	465
860	465
860 Series A (auto radio)	465
867	465
878 Series A and B	465
879, 879 Series A, 880	465
880A, 880B (auto radios)	175
880C, 880D (auto radios)	465
881 (auto radio)	262.5
888, 889, 890	465
900, 904	465

(Cont'd)

BELMONT—*(Cont'd)*

Model	kc
910	465
920	465
1050	175
1070 A, B	465
1075 Series A & B	465
1077	465
1125, 1128, 1129	465
1133, 1134, 1135	465
1139, 1140, 1141	465
1142, 1143, 1144	465
1170, 1170A	465
1170B, 1170C	465
1171 Series A	465
1172 Series A and B	465
1173	465
1174, 1175	465

BOSCH
(United Amer. Bosch Corp.)

Model	kc
05	465
10	175
20, 20-J, 20-K, 20-L	175
22	175
31, 32, 36, 37	175
40, 41, 43, 45-A	175
45-C (auto radio)	175
79, 79-C (auto radio)	175
91, 92	175
100, 100 (auto radio)	175
108, 108 (police radio)	175
117	456
118 (police radio)	175
119, 127, 129, 139 (police radios)	456
140	175
140A	456
149 (police radio)	456
150, 150 (Ed 1 & 2)	175
150A (auto radio)	175
160 (auto radio)	175
224, 226	175
236, 237	175
242, 243	175
250, 251	175
260, 260-C, 260-R	517.5
261	517.5
305, 305A	456
307	175
310, 310A	175
312, 312-C, 312-G	175
313	175
325 (export)	125
350, 352	175
355, 357	175
360	456
360E, 360M, 360S, 360T	456
361, 364	456
370, 370E	265
370M, 370S, 370T	265
376, 376BT	456
376F, 376N, 376S	456
385, 386	463
402, 405	456
420, 421	456
430, 430J, 430T	450
431, 431J, 431T	450
434, 434J, 434T	450
440, 440C, 440T	456

(Cont'd)

BOSCH—*(Cont'd)*

Model	kc
441C, T, 444C, T	456
450, 450L, H	450
451L, H	450
454L, H	450
460	456
460-A, 460-B, 460-R	456
461	456
461A, B, R	456
462-A, 462-B	456
462-V, 462-Y	456
464A, B, R	456
470, 470G, U	456
471, 471G, U	456
474, 474G, U	456
480, 480D, 480R	456
481, 484	456
500, 501	456
502, 503	456
505	465
510, 510E, 515	465
524, 524A (auto radio)	456
536, 536B (auto radios)	456
565, 565K, 565W	465
575, 575F, 575Q	465
585, 585Y, 585Z	465
595, 595M, 595P, 595Q	465
600, 601	465
602, 602C, 602T	465
604, 604 (AC-DC)	465
604B (AC-DC)	465
605, 605C	465
610, 610A	465
620, 625	465
634, 634A (auto radio)	175
636, 637 (auto radios)	175
640, 650	465
660, 660C, 660S	465
660T	465
670, 670C, 670S	465
678	100 and 465
678AC	465
680	465
736, 736A2	175
737, 737A2	175
738, 738A2	175
802, 803 (auto radios)	175
805	456
809, 809 AC-DC	455
811, 811 AC-DC	455
812, 812 AC	455
814, 817, 818, 819	455
823, 828, 829, 830	455
833	455
838 (auto radio)	175
841, 842, 843, 844	455
850, 850M-E	455
853, 854, 855	455
856, 856AC	455
860AC	465
860 M-E	455

BLACKHAWK

Model	kc
6U	262.5

BOND RADIO CO.

Model	kc
6TA	456
34-33	456

BRETING
(Breting Radio Mfg. Co.)

Model	kc
Breting 9	432
Breting 14	432
Breting 14AX	432
Breting 49	1600

BROWNING-DRAKE CORP.

Model	kc
40, 80	175

BROWNING LABORATORIES, INC.
(See also listings under Tobe)

Model	kc
35, 83	456

BRUNSWICK
(Now mf'd by The Mersman Bros. Corp.)

Model	kc
AVC-D	175
D	175
3-NC-8, 3-NW-8	180
5-NC-8	180
11, 12	175
16, 17	175
24, 25, 25AC	175
33, 33 AC	175
1559, 1569	455
1669, 1689	455
2559, 2669, 2689	455
3689, 4689	455
5689, 8109	455

BUICK
(See listings under United Motors Service)

BULOVA
(Bulova Watch Co.)

Model	kc
M701	175
C-751	175
G-781	175
M-701	175
600, 601	175
605	175
610	175

CABLE-NELSON
(See Howard)

CADILLAC
(Cadillac Motor Car Co.)

Model	kc
06W, 072	262
5X	175
6KB, 6Q	175

(Cont'd over)

CADILLAC—(Cont'd)

Model	kc
6S	175
C8	456
55-X	175
56-KB, 56-Q	175
56-R, 56-S2	175
56-T2, 56-U2	262.5
56-V1	262
2029, 2029A, 2030	175
2721(072)	262
2722(072A), 2772	262
1425470	175
1425471	175
7235202	262

CANADIAN WESTINGHOUSE
(See listings under Westinghouse (Canadian))

CAPEHART
(The Capehart Corp.)

Model	kc
50-E, 51-E	465
60-E, 61-E	465
200	175
202	465
204-E, 205-E	465
300	175
301-C, 301-CAW	465
302-D	465
304-E, 305-E	465
400	180
400-A, 400-B	180
400-BAW	465
400-C, 400-CAW	465
400-D	465
400-E, 400-ER	465
401	180
402	180
402-B	180
402-BAW	465
402-C, 402-CAW	465
404-B	180
404-BAW	465
404-C, 404-CAW	465
404-D, 404-E	465
405-D, 405-E	465
406-D, 406-E	465
407-E	465
500-E, 500-ER	465

CAPITAL
(Capital Radio Co.)

Model	kc
B-234, B-235	456
B-240	175
B-241, B-243	456
C-110	456
C-117	175
C-119	456
C-121	456
W-112	456
W-114, W-115, W-120	456

CAR-LECTRIC

Model	kc
110AC-6 volt	175

CAR'USO
(See Laurehk Radio Mf'g. Co.)

CASE
(Case Electric Corp.)
(Now mf'd. by Majestic Radio & Telev. Co.)

Model	kc
Charlie McCarthy No. 1	455
Charlie McCarthy No. 2	455
Chassis 16, 16A	262.5
Chassis 17	262.5
Chassis 19, 19A	262.5
Chassis 27, 27A	262.5
Chassis 110, 110A	262.5
L19, L27	262.5
52, 62-A, 62-B	455
511, 519-P, 519-PA	455
551, 551-A	455
601 (16SM)	262.5
610, 610R	262.5
618	262.5
629, 639, 639-B	455
701 (16SME)	262.5
710, 710A, 710AR, 710E	262.5
713, 713A, 713AR	262.5
714, 714A, 714AR	262.5
715, 715A, 715AR	262.5
716, 716A, 716AR	262.5
718, 718A, 718AR	262.5
719 (17), 719A, 719AR	262.5
739	455
801, 802 (27SME)	262.5
915, 916	262.5
917, 918	262.5
939	455
1015, 1015R	262.5
1016, 1017, 1017-3	262.5
1017R, 1017R-3	262.5
1931C, 1941, 1981	262.5
7113, 7113R	262.5
7170, 7170A	262.5

CAVALCADE RADIO CO.

Model	kc
357, 359, 3511	456

CAVALIER MOTORS ASSOCIATES, LTD.
(Autophone)

Model	kc
M85S (auto radio)	456

CENTURY
(Century Radio Products Co.)

Model	kc
Ace	175
Queen	175
489	175
679	175

CHAMPION RADIO LABS.
(Champion, La Salle, Monarch, Victory. See also listings under La Salle, Royal, Wizard)

Model	kc
A-31	456
5-T	465
6-T	465
52	456
52-DWG	456
400	175
500, 501	456
521UD	456
525DWG	456
526DWG	456
538	456
557, 558	456
600 (auto radio)	175
601 (auto radio)	175
602 (auto radio)	262.5
633G	465
811	465
1437	465
1471-E	465
4169-E	465
5138, 5238, 5338	456
6138, 6238	456
6320	465
6338	456
7338, 7373	465
8338, 8373	465

CHEVROLET
(See Chevrolet listings in United Motors Service section)

CHRYSLER
(Also see Chrysler Models listed under Philco Radio & Television Corp.)

Model	kc
B6, B6F	260
C-1423, C-1450	260
C-1452, C-1550	260
CRD, CT-2	260
CT-5, CT-10	260

CLAGO
(Clago Radio Corp.)

Model	kc
61	175
72	175
84	175
Radiokeg	175

CLARION
(See listings for "CLARION" receivers made by Clarion Corp., and also listings for "CLARION" receivers made by Transformer Corp. of America)

CLARION CORP. (Clarion)

Model	kc
70, 71	456
400, 401, 407	456
500	456
600, 601	456
750, 751	456

CLIMAX (Climax Radio & Telev. Co., Inc.)

Model	kc
Bronze	456
Crown	456
Emerald	456
Esquire, Esquire, Jr.	456
Gold	456
Mona	456
Pearl	456
Ruby	456
Silver	456
Vision	456
2-Volter	456
6-Volter	456
AB, ABX, A64, A65	456
AC60, AC61, AC64	456
AC64B, AC65	456
AD, AD6, AH	456
AHE, AJ, AKE	456
AO, ASE, ATE, AX	456
BC, D8, G, G-4	456
H-5, HE, HE5	456
J-6, JE, JE6, JE7	456
JE27, JEBT, JL	456
K-6, L-91, M	456
M-8, M-17, MB	456
ME, ME9, ME17	456
MEBT, R, U	456
U5, U60, U61, U64	456
U64B, U65, UE, UE5	456
V-5, 35, 35A	456
40, 41	456
50-59 Ince.	456
90-93 Ince.	456
110, 115	456

CLINTON (Clinton Mf'g. Co., Inc.)

Model	kc
2V5	456
6V6	456
7V6-C1	465
52	456
54P	456
55P	456
56P	456
57PG	456
58PG	456
59PG	456
C62XQ	456
C71XF	456
C83	456
C93	456
C113XF	456
G123	456
115, C-123	465
135, 136, 137	465
140, 145	465
146, 147	465
148, 149	465
145, 146	264
C-154	465
AC-155	465
C-155	465

(Cont'd)

CLINTON—(Cont'd) (Clinton Mf'g. Co., Inc.)

Model	kc
157, 158	465
196 (Earlier)	465
196 (Later)	456
197	465
215, 216, 217	465
240	465
245, 247, 249	465
257	456
295, 296	465
297	456
298, 300	465
500, 501	456
532	465
549	465
600, 601	465
610SP	456
615SQ	456
612SP, 615XQ	456
620XP, 621XQ, 622XF	456
629SP	456
629SPI	456
629XP	456
636, 636V, 638	465
701, 702, 703	465
716SQ, 717SF, 723XF	456
735, 800	465
801, 802 (auto radios)	456
803 (auto radio)	447.5
804, 805 (auto radios)	456
806, 807 (auto radios)	456
808, 809 (auto radios)	456
818SF, 824XF, 831SP	456
901	456
1101	465
1102	456
1501	456

CLINTON (Radio Products Sales Co.)

Model	kc
158 (8 tube)	456
178	450
197 (5 tube)	456
245 (7 tube)	456
247 (7 tube)	456
249 (7 tube)	456
257 (8 tube)	456
296 (6 tube)	456
615, 630	456
716 AX (PB)	456
725SF, 725XF	456
804, 805, 805B	456
807, 824XF	456
1101 (11 tube)	456
1501 (15 tube)	456
7312 (11 tube)	456

CLIPPER (Radio Products Sales Co.)

Model	kc
60 (1937 & 1938)	456
78 (5 tube)	465
78A, 78B, 78C	460
78F	465
78G	460

COLONIAL (Colonial Radio Corp.)

Model	kc
C-90	175
C-90A, C-90B	175
C-399	175
C-495	175
C-595	175
C-695, C-995	175
C-1495	175
GB-330, GB-340	180
GB-600	175
GG-15	175
T-345, T-397, T-399	175
44, 47, 48, 50, 51, 52	175
55	1,000
56	175
62, 69, 71, 73, 76	175
*90, *90A, *90B	175
94	175
100, 106, 106-B	175
119, 129	175
147	175
150	480
164, 164-B	175
173, 178	175
182, 182-B	175
222	445
227	480
231, 232, 235	480
237, 238, 239	480
240AC	490
242	480
250 (Chassis 128-A, 128-B)	175
250AC, 250-300AC-DC	175
252	480
265	175
279 (Chassis 128-A, 128-B)	175
279AC	175
300 (Chassis 128-A, 128-B)	175
300AC, 300AC-DC	175
301, 301AC	175
†345	175
†397	175
*399, 400	175
C495	175
500, 500AC	175
501, 501AC	175
*595	175
600, 600-A, 601, 602	175
603	480
604	445
605, 650	175
651, 652, 653, 654, 655	480
656	175
657, 658	480
659	480
662	480
*695	175
700, 700AC	175
701, 701AC	175
702, 702AC	175
*995	175
1495	175

* See also the corresponding listings under letter "C" models, such as C-90A, C-90B, etc.

† See also the corresponding listings under letter "T" models, such as T-345, etc.

COLUMBIA
(Columbia Phonograph Corp.)

Model	kc
C-25B	175
C-53, C-54, C-55	175
C-59	175
C-80	175
C-80-A, C-80-B	175
C-81	175
C-83, C-84, C-85	175
C-90, C-90A, C-90B	175
C-93, C-94	175
C-120, C-120-B	175
C-123	175
C-220, C-223	175
C-256	175
C-550	175
C-559	175
C-800	175
32, 34	175

COMET
(See Hammarlund Mfg. Co., Inc.)

COMMONWEALTH RADIO MFG. CO.
(Com-Rad, Alonson, Star Raider)

Model	kc
A-60	456
150, 160, 180	456
260	456
550, 660	456
880	456

COM-RAD
(See Commonwealth Radio Mfg. Co-)

CONTINENTAL RADIO & TELEVISION CORP.
(Admiral)

Model	kc
A1, A31, A32	456
A90, A126, A128, A346	456
AM3, AM4, AM5	456
AM6, AM7, AM8	456
AM357, AM387	456
AM458, AM488	456
AM557, AM587	456
AM658, AM688	456
AM757, AM786, AM787	456
AM859, AM889	456
AZ282, AZ393, AZ482	456
AZ593, AZ594	456
B1, B2, B3	456
B125, B127, B129	456
B225, B227	456
B325, B327	456
BA41	456
CL583, CL684, CL783	456
L2, L4, L5, L6, L7	456
L215A, L266	456
L477, L567	456
L668, L767	456
M1, M3, M5	456
M169, M351	456
M551, M587	456
ML4, ML156, ML215A	456

(Cont'd)

CONTINENTAL RADIO & TELEV. CORP.—(Cont'd)

Model	kc
ML266, ML366	456
ML477, ML481	456
MX2, MX210, MX218	456
MX238, MX239, MX240, MX241	456
U6, U6B, U6W	175
X1, X4, X5, X6, X7, X8	456
X118, X140, X141	456
X423, X541	456
X641, X718, X741	456
X813, X821	456
Z2, Z3, Z4, Z5	456
Z242	456
Z282	465
Z344	456
Z393	465
Z442, Z443	456
Z482	465
Z544, Z545	456
Z593	465
4A, 4B, 4C, 4D	456
4D-PH	456
5A, 5AZ	456
5B	455
5D, 5DL, 5E, 5EA	456
5F, 5J, 5L, 5LL	456
5M, 5S, 5VU	456
5X, 5Z	456
6A, 6B, 6C, 6D	456
6G, 6H, 6K, 6L	456
6P, 6PU, 6Q	456
6W, 6Y	456
7A, 7G, 7J, 7M	456
7MU	456
8A, 8AU, 8K	456
8T, 8TU, 8MU	456
9G	456
11A, 11S	456
16R, 16S	456
55 (auto radio)	456
61	456
66, 69 (auto radios)	175
77, 78, 88 (auto radios)	175
100-C, 102-6B, 103-6B	456
113-5A, 114-5A, 115-5A	456
123-5E, 124-5E, 125-5E	456
126-5E, 129-5F, 132	456
132, 133-6C	456
133-7G, 134-8A	456
137-6C, 137-7G	456
137-8A, 137X	456
139-11A, 140-16S	456
141-4A, 142-8A	456
144-11A, 144-16S	456
150, 150X	456
155, 155X	456
171, 171X, 190	456
510-6B, 512-6D	456
516-4B, 516-5F	456
516-5G, 517-5F, 517-5G	456
520-5F, 521-5F, 521-5G	456
527-5X, 535-5J	456
547-6G, 549-6G	456
770, 780 (auto radio)	175
880 (auto radio)	175
915-9B, 915-9G	456
920-6Q, 925-16R	456
930-16R, 935-11S	456
940-11S, 945-8K, 945-8T	456
950-6A	456
950-6P, 950-7M	456
955-8K, 955-8T	456
960-8K, 960-8T	456
965-6A	456
965-6P, 965-7M	456
975-6W, 980-5X	456
985-5Z, 985-6Y	456

(Cont'd)

CONTINENTAL RADIO & TELEV. CORP.—(Cont'd)

Model	kc
990-5Z, 990-6Y	456
1907, 1939	456
1954X, 1957	456
7169	456

CORD MOTORS
(See Cord listings in United Motors Service section)

CORONA
(Corona Radio & Television Corp.)

Model	kc
105 (auto radio)	456
108, 110	456
123	456
130 (auto radio)	456
204, 205	456
206, 207	456
208, 209	456
210, 211, 212	456
214	456
223 (auto radio)	175

CORONADO
(See also Gamble-Skogmo, Inc. and Kingston)

Model	kc
11-B	456
540	456
541A, 552A, 552B	456
650-A-B-C	456
675A	456
678	465
685B, 690B	456
715B, 802A, 803A	456
806A, 807B	456
810-B	456
813A, 813B, 816B	456
850B	456

CORSAIR
(See Crosley)

CRANE
(The American Radiator Co.)

Model	kc
23T8LW	177.5

CROSLEY
(The Crosley Radio Corp.)
(Band-Box, Corsair, Crosley, Gembox, Gemchest, Jewelbox, Roamio, Showbox. Also see De-Forest Crosley)

Model	kc
Bonniboy	175
Buccaneer	450
Chief	181.5
Clipper	450
Constitution	450
Corsair	450
Cruiser	450
Fiver	450
Fiver LB	181.5
Galleon	450

(Cont'd)

CROSLEY—*(Cont'd)*

Model	kc
Merrimac	450
Monitor	450
New Travid	450
Privateer	450
Roamio	456
Viking	450
Battery-4, 5, 6, 8	450
Battery-46	450
Battery-62, 62A	450
Dual 60, Dual 60 Lowboy	181.5
Dual 70, Dual 70 Lowboy	181.5
A-155	181.5
A156 (auto radio)	262.5
A-157 (auto radio)	455
A-158 (auto radio)	455
A-166 (auto radio)	262
A-167 (auto radio)	262
A168, A169	455
A-177 (auto radio)	262
A-255	450
A258, A259	455
A-266, A-267 (auto radios)	262
A-268	455
A-355	450
A-358	455
A-366 (auto radio)	262.5
A-455, A-555	450
B-250	450
B-345, B-375	450
B-425, B-445, B-495, B-499	450
B527A, B557A, B557M	455
B-599	450
B-637	262
B-675, B-695, B-699	450
B-899	450
C-516 (506)	450
C-526, C-529	450
C-647A	455
4A1 (auto radio), 4B1, 4C1	456
5A1 (auto radio), 5A2, 5A3 (auto radio)	181.5
5B2	456
5B3	456
5C2	181.5
5C3	456
5H1	456
5M3, 5M4, 5M5	456
5V1, 5V2	181.5
6B1	456
6H2, 6H3	456
6V2	181.5
7H2, 7H3	456
7V2	181.5
8B1	181.5
8B3	456
8H1, 8H3	456
10P3	181.5
32DC6	450
45 BV (Commuter)	455
46 (435)	450
50, 50 Lowboy, 50LB (5H1)	456
51	181.5
61, 61 Lowboy	456
72, 72 Lowboy	456
80-AW, 80-AW Lowboy	456
95, 96 (auto radios)	181.5
98, 99 (auto radios)	181.5
102, 103 (auto radios)	181.5
119	181.5
120 (all), 121, 121-1, 122	175
123, 123 Super	175
124 (all)	175
125	175
126 (all), 127 (all)	175
128	175
129 (all)	181.5
130, 130-1	181.5
131 (Bonniboy)	175

(Cont'd)

CROSLEY—*(Cont'd)*

Model	kc
132-1, 132-J	181.5
133	181.5
134 (all)	181.5
135	181.5
136 (all)	456
136-1	456
137	181.5
141, 143	181.5
146 (all)	181.5
148	456
150	181.5
154, 155	456
*156	456
157, 158	181.5
159 (32 V.)	456
160	181.5
163	456
164	181.5
*166	456
167 (1316)	450
167 Series I & II	456
168	181.5
169	456
170, 171	181.5
172, 173, 173-5	456
174	456
175	181.5
176, 178	456
179, 180	181.5
181 (Dual 60), 182, 184	456
189	181.5
250, 251	450
*266	262
295, 299	450
349	450
*366	262
395	450
415, 416	450
425	450
435, 435-AF, 435-MF	450
458, 468, 488	455
495, 499	450
505, 505MK	450
506 (For Serial Nos. above 1,308,741)	450
507	455
515	450
516	450
517 (Fiver), 517A, 517B	455
517HA, 517-KD, 517M	455
518	455
525-505, 525-B	450
526-5526	450
527	455
529	450
534	456
535, 535-AF	450
535-BH, 535-MF	450
536-5536	450
537	455
545, 546	450
547 (Teletone Fiver), 547-A, 547-B, 547-M	455
547 (Late)	450
548	455
555-5555	450
556	450
557	455
558	455
566	450
567, 567M, 567N, 567P	455
577	455
586 (Batt. Set)	262
587	455
588	456

* See also the corresponding listings under letter "A" models, such as A-156, A-166, etc.

(Cont'd)

CROSLEY—*(Cont'd)*

Model	kc
588C	456
588D	456
588E	456
596	450
597	455
605, 605-BG	450
605-CC, 605-MG	450
614	456
615, 616	450
617	455
618	455
626	450
628	455
629	450
634, 635, 636	450
637, 637A, 638	455
644	450
645, 645-CB, 645-MB	450
646	450
647, 648	455
649, 655	450
656-5656	450
666-5666	450
667, 668	455
676	450
699	450
714	456
715, 716	450
718	455
725, 726	450
736	450
744, 745	450
759, 769	450
814	456
815, 815-EC, 815-NC	450
816	450
817	456
817A	455
818	455
828	455
855, 865	450
899	450
914, 915, 916 (117)	450
926, 955	450
989	450
1014 (Centurion)	456
1016	450
1018	455
1026	450
1055	450
1117, 1117A, 1117M	455
1118	455
1126	450
1127, 1128	455
1137	455
1155, 1199	450
1211, 1216	450
1217, 1218	455
1227	455
1313	450
1316	450
1336	450
1516	450
5515	450
5516	450
5517	455
5526	450
5536	450
5548	455
5555	450
5587	455
5597	455
5628	455
5656	450
5666	450
6515	450
6516	450
6615, 6615-FC, 6615-PF	450

(Cont'd over)

CROSLEY—(Cont'd)

Model	kc
6518	455
6625	450
7739	455
J7739	455

CRUSADER

(See Pacific Radio Corp. Los Angeles)

DAY-FAN

(See General Motors Corp.)

DE-FOREST CROSLEY

(Part of The Crosley Radio Corp.)

Model	kc
140	175
405A, 405B, 405C	175
405D, 405E, 405F	175
500, 501	175
607	175
608A, 608C	175
705A, 707A	175
801	175
840, 850	175
851A, 851C	175
853, 855, 855B	175
902, 905, 907	175

DAYRAD

(See Radio Products Corp.)

DELCO

(See Delco listings in United Motors Service section)

DE SOTO MOTORS CORP.

(See listings for De Soto auto radio receivers under Philco)

DETROLA

(Detrola Radio & Television Corp.)

(Detrola, Road Chief, Road Master. Also see WARWICK)

Model	kc
Roadmaster	456
Warwick	456
5 Tube Midget	456
5B, 5B3	370
5D, 5D1	455
5W Models	370
5WG, 5WG1	370

(Cont'd)

DETROLA—(Cont'd)

Model	kc
5X Models	370
6A	262
6M, 6R (auto radios)	262
6W Models	370
6X, 6XM	370
6Z1, 6Z3	370
6ZM Models	370
7A, 7A3	262
7X1, 7X3	262
7ZM Models	370
7ZM1, 7ZM3	370
10Z1, 10Z3	456
10ZM Models	456
100, 100A, 100C	456
101, 101A	456
102, 102A, 102B, 102C	456
103, 103A	480
105A, 105C	456
106, 106A	456
108, 108A	456
109A	456
110, 110A	456
111, 112 (auto radios)	262
114, 114A	456
116, 116A	456
117, 117A	480
122	385
125, 127, 128, 129	456
131, 132, 133	456
134, 134A	456
135, 136, 137, 138	456
139, 140, 142	456
144, 144B, 144C	456
145, 145EA, 145ECR	456
146, 147, 148	456
149, 149A, 149E	456
150, 151, 152, 154	456
155	385
155X	456
163, 164, 165	456
166 (auto radio)	456
167, 169	456
171 (auto radio)	262
172, 173, 174, 175	456
175E, 177, 177A, 178	456
178A, 179	456
180 (6 V. Bat.)	456
182, 183, 184 (6 V. Bat.)	456
184A, 185, 187, 188	456
190, 191, 192, 193	456
194, 195, 199	456
205, 206, 207, 209	456
210, 211, 212	456
215, 217	456
219, 220, 221, 222	456
223, 225, 225A	456
226, 226A, 227, 227A	456
228, 228AP	456
231 Series	456
243, 246, 248, 249	456
250, 251, 253, 254	456
254A, 255A	455
256	456
256A, 257A	455
258, 259	456
262	456
267	455
270	456
270PC	455
274	455
276U	455
281, 282, 283, 284	455
286, 288, 293, 295-1	455
297	455
301, 302, 303, 305	455
310, 314, 315, 318	455
319, 320, 321	455
322	456
324	455

(Cont'd)

DETROLA—(Cont'd)

Model	kc
325, 326, 329	455
333, 342	
503	456
1200	175
1900	175
2741, 2742, 2811	455
3051, 3101	455
3201, 3202	455

DE WALD

(De Wald, Pierce Airo, Inc., United Scientific Labs.)

Model	kc
A-517	456
A-605, A-606	175
A-607-LW	456
A-617	175
AC746-7M	175
B-A-G	175
B-A-H, B-A-H-9	175
B-A-K	465
B-A-M	465
B-L-G	115
K-A-F	175
50, 51	175
52	175
55, 55-R, 55-X	456
56	456
58, 58-EX	456
58-L, 58-R	456
59, 60	456
60EX (Early)	455
60EX (Late)	175
60-R	456
61, 61-X	456
62	175
80	456
81, 81-R	456
90	262
100	456
408R, 409	455
415, R415	455
440	456
500-A	130
501, 501-A, 501-B	456
503, 504	456
505, 505-F	456
505-R, 505-R-L-W	456
507, 508	456
510, 510-B	456
511	456
517, 517-R (auto radios)	456
520	456
522, 523	456
525, 526	456
527 (auto radio), 529	456
529LW, 533	456
533LW, 536	456
536LW, 537	456
537LW	456
537LW, 538, 538L	456
538LW, 539, 539LW	456
542, 542LW	455
544, 545, 545LW	455
545SW	455
550, 551	456
553, 553-4S	456
554-S	456
560	465

(Cont'd)

DE WALD—(Cont'd)

Model	kc
570	455
580-R	456
600, 600-A, 600A-R	456
601	460
602	456
603, 603-A, 603-R	456
604	456
605, 605-R (auto radios)	175
606, 606-R (auto radios)	175
607 (auto radio)	456
608 (auto radio)	177.5
609, 609-SA	456
610, 610-LW	456
610-SA, 610-SA-LW	456
610-SC, 610-SC-LW	456
611, 611-LW	456
611-SA, 611-SA-LW	456
612, 612-LW	456
612-SA, 612-SA-LW	456
614	455
615, 615-LW, 616	456
617 (auto radio)	175
618, 618LW, 619	456
620, 620-LW	456
621, 621-LW	456
622	456
623, 624, 626	456
629, 629LW, 630	456
633, 633LW, 633S	456
635, 635LW, 636, 637	456
640, 640-R (auto radios)	175
642, 643, 645, 645LW	456
648, 648LW, 649	456
649LW, 650, 650LW	456
651, 651LW, 652	456
655, 655LW	456
656, 656LW	456
658, 658LW, 661	456
662, 662L	455
663, 665, 666	455
700, 700A, 700B	456
700C, 700LW, 700ALW	456
701, 701LW	456
702	175
703, 703LW	456
704, 704LW, 705	455
735	175
746, 747	175
800, 801	456
802, 802-C	456
803, 804, 804S	456
805, 805-A, 805-C	456
805S	456
807, 808-C	456
811, 811-A, 811-R	456
901, 901-C, 901-2	456
902, 902-C	456
1000, 1001, 1002, 1002B	456
1003, 1003B, 1004, 1005	456
1100 (Early-Late)	456
1100-C	456
1102, 1102-3, 1103	456
1104, 1105	456
1200, 1200-C, 1201	456
1300-C	456

DICTOGRAPH
(Dictograph Products Co., Inc.)

Model	kc
91134	456
91134A	456
91168	456
91175	456

DODGE MOTOR CORP.
(See listings of "Dodge" auto radio receivers under Philco)

DUNN-HALL
(Dunn-Hall Co.)
(Air Raider)
(Dunn-Hall, Remington, Tiny Tim)

Model	kc
45, 51 (Dunn-Hall)	465
52 (Tiny Tim)	460
53 (Dunn-Hall)	465
61, 63 (Dunn-Hall)	465
157 (Remington)	465
161, 163 (Remington)	465
250, 258 (Remington)	465
353, 354, 354A (Dunn-Hall)	465
354-AC, 354-C	465
363, 364, 364A (Dunn-Hall)	465
364-AC, 364-C	465
381 (Remington)	465

DYNAPHONE
(See Ansley Radio Corp.)

ECOPHONE
(Ecophone Radio Corp.)

Model	kc
F	175
S-5	175
5, 10, 12	175
14, 15	175
16, 17, 18	175
20	175
35, 36	175
38	175
50, 55	175
60	175
62	115
65	175
70, 70DC	175
72	115
75	175
80, 81, 90	175
92	115
100, 111, 112	456
119	456
124, 125, 126, 128	456
130	456
133	175
139, 139C, 143	456
160	456
1734, 1734A	456
7114, 7124, 7127	456

EDISON-BELL
(Edison-Bell Co., Inc.)

Model	kc
43, 44, 45	175
53	175
53-LW	115
55-AW	456
63	175
63-LW	115
64	456
64-LW	115
66-AW	456

ELECTRIC AUTO LITE

Model	kc
062-A, 072-A	262
3622	262
3722	262

E & A
(Electric & Automotive Products Co.)

Model	kc
IL-5	125
IL-55, IL-55LW	125
SW-6	456
6-AW	456
25-AW	456
30-AW, 35-AW	456
303, 303-LW, 303-SW	456
405, 405-LW	456

ELECTRICAL RESEARCH LABS., INC.)
(See listings under Sentinel Radio Corp.)

ELEC. SPEC. EXPORT CORP.

Model	kc
R-502	456
69	456

ELECTROTONE
(See Harris)

EL REY
(El Rey Radio Mf'g. Corp.)

Model	kc
7 Tube AW	262.5
A, B, C	465
10, 15, 20	465
644, 645	465
845	465

EMERSON
(Emerson Radio & Phonograph Corp.)

Model	kc
Chassis A	456
Chassis AH	455
Chassis AL, B	456
Chassis BG, BQ, BR	455
Chassis BS, BU, BW, BY	455
Chassis C, D	456
Chassis E-5, F, F-5, F-7	456
Chassis H, J, K, L	456
Chassis U4A, U5A	456
Chassis U6A, U6B, U6E	456
A-7, A-8, A-11	456
A-130, A-132	456

(Cont'd over)

EMERSON—*(Cont'd)*

Model	kc
A-148	456
AA, AA-131	456
AA-204, AA-207	455
AB-178, AB-182, AB-183, AB-184	456
AC-130, AC-149	456
AC-168, AC-202	456
AD-108, AD-110, AD-125	456
AE-107	456
AE-163	456
AF-171, AF-173, AF-176	456
AF-179, AF-180, AF-185	456
AG-151	456
AH-162	456
AH-166, AH-171, AH-173	455
AH-174, AH-176, AH-179	455
AH-180, AH-185	455
AJ-130, AJ-137, AJ-149	456
AJ-192	455
AL-130, AL-130LW, AL-132, AL-132LW	456
AL-149, AL-149-LW	456
AL-164, AL-164LW, AL-168, AL-168LW	456
AL-202, AM-131	456
AM-131LW, AM-153	456
AM-169	456
AM-169LW, AM-181LW, AM-187, AM-187LW	456
AM-204	456
AP-165	456
AP-166, AP-171, AP-173, AP-174	456
AP-176, AP-177, AP-180, AP-185	456
AR-165, AR-166, AR-171	456
AR-173, AR-174, AR-176	456
AR-177, AR-180, AR-185	456
AS-179, AT-170, AT-172, AT-181, AU-190	456
AU-213, AV-193	455
AW, AW-55	455
AW-171, AW-173, AW-174	456
AW-176, AW-180, AW-185	456
AX-211, AX-212, AX-217	455
AX-219, AX-221, AX-222	455
AX-232, AX-233, AX-235	455
AX-237, AX-238, AX-239	455
AX-240, AX-241	455
AXLW-211, AXLW-212	455
AXLW-217, AXLW-235	455
AXLW-237, AXLW-238	455
AXLW-239, AXLW-257	455
AY-194, AY-195, AZ-196	456
AZ-196	456
B-5	456
B-6, B6L	456
B-8	456
B-10	172.5
B-11	456
B-131, B-131-LW	456
B-231	455
B-AC-10	175
BD-197, BE-198	456
BF-169	455
BF-191	456
BF-204, BF-207, BG-138	455
BG-140, BG-142, BG-146	455
BG-178, BG-182, BG-183	455
BH-203	456
BJ-200, BJ-210, BJ-214	455
BJ-218, BJ-220	455
BL-200, BL-210, BL-214	455
BLW	456
BO-229, BQ-223, BQ-225	455
BQ-228, BQ-233, BR-224	455
BR-224A, BR-226, BS-227	455
BT-245	455

(Cont'd)

EMERSON—*(Cont'd)*

Model	kc
BL-218, BL-220	455
BU-229, BU-230, BW-231, BY-233	455
C-6	456
C-134, C-134-LW	456
C-136, C-136-LW	456
C-138, C-138-LW	456
C-139, C-139-LW	456
C-140, C-140-LW	456
C-142, C-142-LW	456
C-145, C-145-LW	456
CA-208	455
CA-209	455
CA-234	455
CB-243, CE-259	455
CE-260, CG-268	455
CG-270, CG-272	455
CG-276, CG-318	455
CG-293, CG-294	455
CG1-293, CG1-294	455
CH-243, CH-246	455
CH-256, CJ-211	455
CJ-217, CJ-221	455
CJ-232	455
CJ1-221, CJ1-232	455
CJ-235, CJ-257	455
CL-246, CL-253	455
CL-256	455
CLW	455
CM-260, CM-266	455
CM-267	455
CQ-269, CQ-271	455
CQ-273	455
CR-261, CR-262	455
CR-274, CR-297	455
CR-303	455
CR1-297, CR1-303	456
CRLW-261, CRLW-262	455
CRLW-274	455
CS	175
CS-268	455
CS-270, CS-272	455
CS-276	455
CT-275	455
CV-265, CV-280	455
CV-289, CV-290	455
CV-291, CV-295	455
CV-298, CV-313	455
CV-314, CV-316	455
CX-263, CX-283	455
CX-284, CX-285	455
CX-292, CX-305	455
CY-269, CY-271	455
CY-273, CY-288	455
CY-319	455
D-6	456
D-55	456
D-134, D-134-LW	456
D-136, D-136-LW	456
D-138, D-138-LW	456
D-139, D-139-LW	456
D-140, D-140-LW	456
D-142, D-142-LW	456
D-146, D-146-LW	456
D-AC-5	456
DB-296, DB-301	455
DB-315, DB-327	455
DC-308	455
DD-268, DD-270	455
DD-272, DD-276	455
DF-202, DF-302	455
DF-306	455
DH-264	455
DJ-310, DJ-311	455
DJ-312	455
DL-330, DL1-330	455
DLW	456
DM-331, DM1-331	455

(Cont'd)

EMERSON—*(Cont'd)*

Model	kc
DP-332, DP1-332	455
DQ-333, DQ-334	455
DQ1-333, DQ1-334	455
DQ-351, DQ-398	455
DR-343, DR-348	455
DR-350, DR-352	455
DR1-343, DR1-348	455
DR1-352	455
DS-5	456
DS-365, DS-372	455
E-128 (auto radio)	172.5
EA-312, EA-338	455
EA-339, EA-357	455
EA-385, EA-389	455
EA1-341	455
EB-344, EB-359	455
EC-242	455
EC-296, EC-301	455
EC-314, EC-315	455
EC-327, EC-336	455
EC-347, EC-353	455
EC-366, EC-376	455
EC-425	455
EC1-296, EC1-301	455
EC1-314, EC1-315	455
EC1-327, EC1-336	455
EC1-347, EC1-353	455
EC1-366	455
ED-354, EF-363	455
EG-355, EJ-378	455
EH-342	455
EH1-342	455
EK-377, EK-403	455
EK2-377	455
EL-360, EL-361	455
EL-362, EL-373	455
EM-345, EM-346	455
EM-382	455
EM1-345, EM1-346	455
EM2-345, EM2-346	455
EMA-382	455
EM3-345, EM3-346	455
EP-367, EP-375	455
EP-381, EP-405	455
EP-406, EP-407	455
EQ-368, EQ-410	455
ER-369, ER-370	455
ES-374, ES-397	455
ET-383	455
EV-384	455
EW-391	455
EX-386	455
F-6D	456
F-117, F-122	456
F-133, F-135, F-141	456
F-143	456
F-159, F-160	456
FA-374	455
FB-374	455
FC-400, FD-396	455
FE-400, FG-330, FH-413	455
FH-440, FJ-412	455
FL-414, FL-415	455
FL-416, FL-417	455
FL-418, FL-419	455
FO-420	455
FP-421, FP-422	455
FR-432, FT-383	455
FU-424	262
FU-427	262
FU-428	262
FV-426, FV-433	455
FW-423	455
FZ-452	455
G, G-5	456
G-127	456
GA-439, GA1-439	455
GA-441, GA1-441	455

(Cont'd)

EMERSON—*(Cont'd)*

Model	kc
GB-439, GB-441	455
GC-448	455
GK-450, GK2-450	455
H-5, H-5A	172.5
H-5L	132
H-5S, H-6A	172.5
H-130, H-137 (chassis A)	456
J (1930), JS	175
J-106	456
K-5	456
KS	175
K-116, K-121, K-123	456
LA	172.5
L-7	115
L-117, L-117-LW	456
L-122, L-122-LW	456
L-133, L-133-LW	456
L-135, L-135-LW	456
L-141, L-141-LW	456
L-143, L-143-LW	456
L-144, L-144-LW	456
L-150	456
L-755	115
M	456
M-134, M-136	456
M-138, M-139	456
M-140, M-142, M-146	456
M-755, M-AC-7	175
P	456
P-117, P-135	456
Q157, Q188	456
R	456
R-152, R-153, R-156, R-158	456
R-167, R-189	456
S	456
S-7, S-50	465
S-147, S-151	456
S-755, S-775	465
T-6	172.5
U	262
U4L, U5B, U5L	132
U5S	456
U6, U6C, U6D	456
U6F, U6L	456
UV-4, UV-5, UV-5-375	456
U-154 (auto radio)	262
V, V-155 (auto radio)	262.5
W-6	175
W-6L	125
X, X-146, X-175, X-178, X-183	456
Z, Z-117, Z-122	456
Z-133, Z-135	456
Z-141, Z-143	456
Z-150, Z-159	456
Z-160	456
1A (auto radio)	172.5
4B	456
5A (auto radio)	172.5
5J, 5S	456
6A (auto radio)	172.5
6BD	456
19	456
23, 26, 28	456
30-AW	456
30-LW	132
31-AW, 31B	456
32	456
32-LW	132
33-AW	456
33-LW	132
34, 34C, 34-F7	456
35, 35-T6	172.5
36	456
38, 38-LW	456
39	456
40, 40-W6	175
41, 42	456
45, 45-LW	456

(Cont'd)

EMERSON—*(Cont'd)*

Model	kc
49	456
50	175
50-L	115
50-M	175
50-S	465
52-CS	175
53-JS	175
55-AW	445
55-L	115
55-S	175
59	456
70-KS	175
71	456
77	172.5
80-KS	175
101, 101-F7, 101U	456
102, 102-LW	456
103	456
104, 104-LW	456
105, 105-LW	456
106	456
107, 107-AC, 107-LW	456
108	456
108-LW	132
109	456
109-LW	132
110	456
110-LW	132
111	456
111 (UGA)	456
111 (UGF)	456
111-LW	456
112, 113	456
114, 115, 116	456
117-LW	132
119	456
121	456
126-LW	132
128	172.5
146-LW	456
161	456
250	172.5
250-AW	456
250-LW	132
280	456
300	172.5
321-AW	456
321-LW	132
350-AW	456
350-LW	132
375	175
375-LW	125
375 (UV-5)	456
375 (W-6)	175
450	456
667, 678 (auto radios)	172.5
755	175
755-L	115
755-M	175
755-S	465
770	456
775-L	115
775-M	175
775-S	465
965 (auto radio)	172.5

EMPIRE

(Empire Elect. Products Co.)

(Also see listings under Fada)

Model	kc
30-L	115

(Cont'd)

EMPIRE—*(Cont'd)*

Model	kc
30	175
40	175
40-L	115
40-SW	456
45-SW	456
50-SW	456
51, 52	175
60	175
71	175
74	462.5
450-A, 460-B	456
470-C, 480-C	456
575	175

ENSIGN

(See Espey Mfg. Co., Inc.)

ERLA

(Electrical Research Labs., Inc.)

(See Sentinel Radio Corp.)

ESPEY

(Espey Mf'g. Co., Inc.)

(Ensign, Espey, Yorker)

Model	kc
451, 458, 459	456
464, 467	456
472	460
481, 545	456
553, 555	456
560, 564, 565, 641	456
671, 674, 675	456
771, 771A, 771B, 771D, 771E	456
771G, 771H, 771J	456
851, 852, 861	456
861A, 861B	456
861C, 861R	456
862	456
881, 891, 894	456
942, 962	456
5101, 5111, 5181, 5191	456
6101, 6111, 6141, 7111	456
7151, 7153, 9162	456

FADA

(Fada Radio & Electric Corp.)

(Also see listings under Empire)

Model	kc
NA, NE	265
RN	470
RP	175
RS	470
RU	265
RV	175
RW	265
RX	125
RY	470
5F60A, AG, AR, AT	456
5F60AU, AX, T	456
5F60V, W, X	456
6A51	456
6A51C, V, W	456
6A54	456
6A54V, W	456
6A60	456
6A60V, W	456
6A61	456

(Cont'd over)

FADA—*(Cont'd)*

Model	kc
6A61C, V, W	456
6A65	456
6A65C, T	456
6A70	456
6A70C, T	456
6A80	456
6A80APC, C, CA, T	456
9	456
15C, 15CA	456
16C, 16CA	456
20, 20A, 20B	456
20G, T, V, W	456
F-25	456
L-26	456
30 (Late)	456
30J, M	456
31, 32 (Late)	456
45 (KU), 45-Z (KU)	175
S46, S46A, S46B	456
S46G, S46R, S46T	456
S46V, S46W	456
48 (KW), 49 (KW)	175
B49, C49	456
P49, T49	456
A50 (auto radio)	456
51 (KOC)	175
52	456
53 (KOC)	175
54V, W	456
F55	456
55 (RG)	175
57 (KOC)	175
59	456
LA60	456
P60, PL60, PUL60	456
60V, W	456
61 (KX)	175
62T, TR, V, W	456
63 (KX)	175
64APC	456
65 (KW), 66 (KY)	175
T65	456
A-66PC, A-66T	456
L67C, L67T	456
68, 69	456
73 (RE), 74 (RA)	175
74APC	456
A-76PC, A-76T	456
76 (RA)	175
78 (RC)	175
78-10	265
79 (RC)	175
79-10	265
83 (RA), 85 (RE)	175
87 (RA), 88 (RA), 89 (RA)	175
93 (RX), 95 (RX)	125
L96	456
97 (RA), 98 (RE)	175
99-10	265
101 (RK)	175
102, 102 (RP)	175
104 (RO)	470
104-B (RV)	175
105 (RN), 106 (RN)	470
107 (RN)	470
108 (RY), 109 (RY)	470
111 (RN), 112 (RS)	470
126 (NK), 127 (NK), 128 (NK)	262.5
130	175
131 (RU), 132 (RU)	265
133 (RW), 134 (RW), 135 (RW)	265
140	175
140L	115
140SW	456
141 (NA)	265
142 (NF)	125

(Cont'd)

FADA—*(Cont'd)*

Model	kc
145	175
145L	115
145SW	456
150, 150C, 150T	456
151 (NE), 152 (NE)	265
155, 156, 157	456
158, 159, 160	456
160C, 160T	456
161, 161C, 161T	456
162, 163, 164, 165	456
166 (auto radio)	175
167, 168	456
170, 170C, 170CK, 170T	456
171-AC (KOC110), 171C, 171CK	456
171-DC (KOC110)	175
171T	456
172	456
173AC-DC (KOC110)	456
173DC (KOC110)	175
190, 190C, 190CK, 190T	456
191, 191C, 191CK, 191T	456
192, 192C, 192CK, 192T	456
193, 193C, 193CK, 193T	456
211, 211B, 211C	456
211CK, 211T	456
212, 212C, 212CK, 212T	456
216, 216C, 216CK, 216T	456
242, 246	456
250	456
250C, T, V, W	456
251DC (KO-220), 253 DC (KO-220)	175
254, 255	456
260, B, D, G, T, V, W	456
261	456
262, D, G, T, U, W	456
265	456
266, 266-SD (auto radios)	175
266-SF, 266-SG (auto radios)	175
267 (auto radio)	175
267SD, 267SF, 267SG (auto radios)	175
267-X (auto radio)	175
270, C, CK, T	456
271, 272	456
272V, W	456
273	456
280, C, T	456
281	456
290, C, CK, T	456
291	456
311, 311B, 312	456
315, 316, 340	456
340B, R, V, W	456
350, 350A	456
350B, 350BRVW	456
351, 351J, K, L, M	456
352, 352J, K, L, M	456
353, 353J, K, L, M	456
354, 354B, BG, D	456
354G, R, RG, V, W	456
355, 355B, BG, D	456
355G, R, RG, V, W	456
360, 360B, BG, D	456
360G, R, RG, V, W	456
361, 361J, K, L, M	456
362, 362B, BG, D	456
362G, R, RG, V, W	456
363, 363J, K, L, M	456
365, 365B, BG, C, D	456
365G, PF, PT, R, RG	456
365T, V, W	456
366, 366C, T, 366PT	456
370, 370B, BG, C, D	456
370G, PF, PT, R, RG	456
370T, V, W	456
372, 372C, T	456

(Cont'd)

FADA—*(Cont'd)*

Model	kc
380, 380C, T	456
382, 382C	456
390, 390C, T	456
392, 392C	456
410, 410C, CA, PC	456
411, 411C, CA, PC	456
413, 413C, PC	456
440V, W	456
450T, V, W	456
451	456
451C, K, L, PT, T	456
454, 454G, T, U, V, W	456
460, 460G, T, V, W	456
461, 461C, K, L, PT, S, T	456
465, 465APC, C, PC, PF	456
465PT, T, TR, V, W	456
470, 470APC, C, PC, PF	456
470PT, R, T, TR, V, W	456
490	456
512 (KOF), 532 (KOF)	175
546B, G, R, T, V, W	456
554, 554PT, 554U	456
560, 560PT	456
732 (RF)	470
852 (RF)	470
1216, 1216T	456
1242, 1242B, BG, C	456
1242D, G, PB, R, RG	456
1242T, V, W	456
1246, 1246B, BG, C	456
1246D, G, R, RG	456
1246T, V, W	456
1250, 1255	456
1262, 1265	456
1450, 1451, 1453	456
1460, 1461, 1462	456
1462D, 1463, 1463D	456
1470, 1471	456
1480, 1481	456
1556, 1582, 1583	456

FAIRBANKS, MORSE
(Fairbanks, Morse & Co.)

(Also see listings under Audiola)

Model	kc
B-6, C-6 (auto radios)	177.5
4A (chassis), 4AC1B, 4AT5B	456
4B (chassis), 4BC1B, 4BT5B	456
5A (chassis), 5AT1	456
5B (chassis), 5BT2	456
5C (chassis), 5CT3	456
5D (chassis), 5DC1B, 5DT3B	456
6A (chassis), 6AC1	456
6AC7, 6AT4	456
6B (chassis), 6BT6	456
6C (chassis), 6CC2B, 6CT4B	456
7A, 7AC, 7AG, 7AT	455
8A, 8AC2, 8AC3, 8AT8	456
9A (chassis), 9AC4, 9AC5	456
9C, 9CC, 9CG	455
12A (chassis), 12-AC-6	456
12B, 12BG	455
12C6 (120 chassis)	456
40, 41	456
42	456
42CIB, 42TOB (42 chassis)	456
43	456
43CIB, 43TIB (43 chassis)	456
51, 52, 53 (chassis)	456
54, 55	456

(Cont'd)

FAIRBANKS, MORSE—*(Cont'd)*

Model	kc
56, 57	456
57TO	456
58	456
58C1, 58T1, 58T2	456
60, 61, 62, 63 (chassis)	456
64 (auto radio)	177.5
64 (home battery set)	456
65, 66	456
67, 68	456
68T6 (68 chassis)	456
69	456
69T7 (69 chassis)	456
70, 71 (chassis models)	456
72, 72C2	456
72C3, 72T3	456
73	456
73C3B, 73T3B (73 chassis)	456
74 (auto radio)	177.5
81, 82	456
90, 91	456
91C4, 91C5, 91T4	456
100, 110, 120	456
346, 346S, 347 (auto radios)	177.5
516-2V	456
541-2V	456
814	175
816	175
840, 841	175
1014	175
1040	175
4015, 4115-B	456
5103	456
5106, 5107	456
5108, 5109	456
5111, 5112	456
5141, 5143	456
5212, 5212A, 5241	456
5312, 5312A, 5341	456
5416, 5445	456
5516, 5545	456
5619, 5645, 5645A	456
6010	456
6044	456
6210, 6244	456
6317, 6346	456
6416B, 6445B	456
6517, 6546	456
6616, 6645	456
6717, 6746	456
7014	456
7040, 7042	456
7052	456
7117, 7146	456
8110, 8141	456
8218, 8247, 8248	456
9047, 9048	456
10049, 10050	456
11049, 11050	456

FANSTEEL
(See Balkeit Radio Corp.)

FARNSWORTH TELEVISION & RADIO CORP.

Model	kc
AC-70, AC-71, AC-90	455
AC-91	455
ACL-55, ACL-56	455
AK-17, AK-76	455
AK-95, AK-96	455
AKL-58, AKL-59	455
AT-10, AT-10P	455
AT-11, AT-11P	455
AT-12, AT-12P	455
AT-14, AT-14P	455
AT-15, AT-15P	455
AT-16, AT-16W	455
AT-20, AT-20P	455
AT-21P, AT-22W	455
AT-23, AT-23W	455
AT-30, AT-31	455
AT-40, AT-40W	455
ATL-10, ATL-10P	455
ATL-11, ATL-11P	455
ATL-12, ATL-12P	455
ATL-14, ATL-14P	455
ATL-15, ATL-15P	455
ATL-16, ATL-16W	455
ATL-17, ATL-50W	455
ATL-51W, ATL-52W	455
ATL-55, ATL-56	455
ATL-58	455
BC-45, BC-72, BC-80	455
BC-81, BC-82, BC-83	455
BC-86, BC-92, BC-101	455
BC-102, BC-103, BC-105	455
BC-601X, BC-1020	455
BC-1020X	455
BK-73, BK-77, BK-78	455
BK-85, BK-87, BK-88	455
BK-89, BK-106, BK-107	455
BK-108, BK-110, BK-111	455
BK-112, BK-602X	455
BK-6025	455
BK-6025X	455
BK-10305	455
BKR-84	455
BT-20, BT-22, BT-41	455
BT-52, BT-53, BT-54	455
BT-55, BT-56, BT-57	455
BT-58, BT-61, BT-63	455
BT-66, BT-68, BT-70	455
BT-600, BT-600X	455
BT-1010	455
BT-1010X	455

FEDERATED PURCHASER INC.
(See Acratone)

FERGUSON RADIO INC.
(See also Champion Radio Labs)

Model	kc
4V6, 6V6PK	456
123-40	465
153-40	465
5140-A	456
6340-AB	465
6340-TZE	465

FIDEL-O-MATIC
(See Port-O-Matic)

FIRESTONE
(Firestone Tire & Rubber Co.)
(See also Stewart-Warner)

Model	kc
F-258 (auto radio)	456
R-1311 (auto radio)	177.5
R-1314 (auto radio)	177.5
R-1322 (auto radio)	177.5
R-1332 (auto radio)	456
R-1431 (auto radio)	177.5
R-1651AS, R-1651WS	456
R-1661	456
R-1781 (auto radio)	262
R-3051, R-3061, R-3069	465
R-3071 to R-3079	465
R-3085	465
R-7406-1	456
R-7407-1	456
S-7424-3, S-7426-6	456
S-7426-7, S-7426-9	455
S-7428-1	456
S-7428-2	455

FIRST NATIONAL RADIO CO.
(See Balkeit Radio Corp.)

FORD—LINCOLN
(Ford Motor Co.)
(Also see Ford and Lincoln-Zephyr models listed under Philco)

Model	kc
B18805	175
F-1440, F-1442	260
F-1540, FN	260
FT6, FT9	260
N	260
V-8	175
40-18805	175
111, 111-40	175
113	175
118, 118P	175
1440	260
5601	252.5

FORDSON
(Fordson Export Co.)
(See also listings under Goldentone and Warwick Mf'g. Co.)

Model	kc
FP (All models)	456
FP-32-V	456
FT (auto radio)	175

(Cont'd over)

FORDSON—*(Cont'd)*

Model	kc
FT (police radio)	175
FU (540-1500 Kc tuning range)	456
(6775-20,000 Kc tuning range)	456
FU (150-1500 Kc tuning range)	456
FW (Midget 115-2300 tuning range)	456
FW (Console 115-2300 tuning range)	456
32	456
41, 42	456
61	456
102	465
320, 321	465
680, 6320	465
7371	465
14371	465

FRANKLIN
(Franklin Radio Corp.)

Model	kc
6T super	175
43-AB	456
45-E, 45E32V	465
53	456
54-A, 54-C, 54-CL	456
54-G, 54-L	456
55-CU	250
55-D	465
55-EU, 55-GU	250
63-L	130
65-HU, 65-HU32	250
65-VU	250
94	450
100	175
102	175
105-C, 105-PC	450
200	175

FREED
(Freed Television & Radio Corp.)

(See listings below, under Freed-Eisemann)

FREED-EISEMANN
(Freed Mf'g. Co., Inc.)

Model	kc
A-7, A-9	456
BG-357-P	456
C-310-AC	456
C-367, C-482	462
FE-48	456
FE-55, FE-57, FE58	456
FE-60, FE-62	456
FE-70, FE-76	456
FE-98	175
FM40, FM42, FM42X, 5M43, FM45, FM45X, FM51, FM52, FM52X, FM53, FM54, FM55, FM55X, FM61	
(Amp. Mod.)	456
(Freq. Mod.)	4300
H-357-L, H-357-P	456
MB-7, MB-9	175
P-55	456
Q-358S, R-369S	456
T-367S, T-368P	456
U-363	456
V-360	456
W-380, W-382	456

(Cont'd)

FREED-EISEMANN—*(Cont'd)*

Model	kc
25, 26, 27, 28	456
51, 51DC	175
55, 56	456
56-L	115
58, 60, 62	456
66, 67	456
70	456
72	175
74	456
76	115
77	456.5
78	462.5
90	456
94	456.5
97, 98, 99	456
353	132
354, 355, 356	456
360, 360-X	175
365, 365-X	456
366	462
366-LW	115
367	462
368	115
406	456
432	456
466, 467	462
469	462
475-X	462
482	462

FREED MF'G. CO., INC.
(See Freed-Eisemann)

FREED TELEVISION & RADIO CORP.)
(See Freed-Eisemann)

JESSE FRENCH

Model	kc
U-1	175
5X, 6X, 7X	175

GALVIN MFG. CORP.
(See Motorola)

GAMBLE-SKOGMO, INC.
(See also Coronado and Kingston)

Model	kc
2-ODM-578	456
6C1	175
6D	175
6J	175
6K	175
7J-512	456
7J-514	456
11B	456
15C6	456
20C7, 20C8	456
22CM-576	456
26B5	175
26FM-552	456
26R1	175
26S1	175
27C1, 27C2, 27C5	175
31BT, 34BT	465
36L, 42DL-670	456
46L, 46L1	175
47LL, 47P608	456
47R, 47RL	456
70	175
72	262
77, 77A	456
90	175

(Cont'd)

GAMBLE-SKOGMO, Inc.—*(Cont'd)*

Model	kc
92, 92DM	175
400A	456
404	465
410B	456
430	456
489	465
501	465
504	465
510, 511	456
516, 521	456
525, 527	456
527A	465
540	456
541A	456
550	456
550AC	456
552	456
571 (Series A)	465
575	175
578	465
585 (Series A)	370
585 (Series B)	370
585C	465
586A	465
587 (Series A)	465
600	456
601 Series A, B, C	465
602	465
602B, 602C	470
623	456
645	456
648	455
650 A-B-C	456
660	175
665 (Series A)	465
666	465
667	262.5
670	175
670A	175
675	370
675A	456
677A, 677B	465
680	175
685B	456
686A	465
686B	465
690B	456
715B	456
735	456
740	465
750	175
761A	465
762	456
767 (Series A)	465
770	465
774 (Early)	456
774 (Late)	456
776	456
777C, 777L	465
778A	465
780, 780B	456
787	465
802A, 803A	456
803B	456
806A, 807B	456
810, 810 (1938)	456
813A, 813B	456
822	465
850B	456
867A	465
907, 908	455
940, 951, 953	456
1050	175
1170	465
2056AW	455
2078D	455
2090	262

(Cont'd)

GAMBLE-SKOGMO, Inc. —(Cont'd)

Model	kc
2092, 2094	262
3128	455
4912, 4914	456
5953A	465
6100	465
6953A	465
7735, 7742, 7755	465
Z516	175
Z521	175
Z530	175
Symphonic	456

GAROD (Garod Radio Corp.)

Model	kc
B-37, B-37D	456
Challenger I, II, III	456
G-6, G-15	175
G-35	456
G-37, G-38	456
G-61	456
M32	456
M33, M33LW	456
PC31	456
Teeny 2, 3, 4, 5	456
2B2, 2B2-1	456
2B6, 2B6-1	456
5LW, 8A3-P4	456
8A4-L, 8A4-T	456
25, 26, 27	456
31, 31LW	456
32, 32LW	456
33, 33LW	456
35-LW	132
35-SW	456
*37, *38	175
37B, 37D	456
49, 49M	456
58	456
60	456
*61	456
66	456
83, 83LW	456
104, 104M	456
115, 159	456
205, 206 Series	456
237, 238	456
250	456
259, 269, 307	456
309-L, 309-P8	456
309-3	456
310	456
311, 311-LW	456
337	456
369, 369T	456
370, 370C	456
370D, 370KC	456
371, 371C	456
371D, 371KC	456
379	456
380, 380D, 380KC	456
381, 381D, 381KC	456
389, 399	456
408-L, 408-T	456
512, 514, 520	456
600, 620	456
602, 602L, 619	456
619C, 629, 703E	456
703EC, 703EL, 729	456
730, 731	456
739, 739T	456

* See also the corresponding listings under letter "G" models, such as G-37, G-38, etc.

(Cont'd)

GAROD—(Cont'd)

Model	kc
762, 782-I	456
769, 803-1	456
782-L, 782-T	456
830, 830A, 830C	456
830D, 830KC	456
831, 831A, 831C	456
831D, 831KC	456
839	456
903-L, 903-P8	456
903-3	456
930, 930A	456
930D, 930KC	456
931, 931A	456
931D, 931KC	456
1039, 1049	456
1203-L, 1203-P8	456
1203-4	456
1204 Series	456
1240, 1240A	456
1240E, 1240LC	456
1603, 1604-4, 1649	456
1650, 1650A	456
1650H, 1650LC	456
2150	456
3012-L, 3012-P8	456
3012-4	456
3016, 3119, 3119K, 3790	456
4012 Series, 4016-4, 4159	456
4110, 4110E	456
4110KC, 4110LC	456
5140, 5140H, 5140LC	456
5240	456
5420, 7090, 7390	456

* See also the corresponding listings under letter "G" models, such as G-37, G-38, etc.

GAYLORD (Gaylord Mfg. Co.)

Model	kc
510S, 510U	456
512	456
520S, 520U	456
610S, 610U	456
612, 615	456
620S, 620U	456
710S, 710U	456
720S, 720U	456
800, 801	465
810, 811, 812	465
900	465
910, 911, 912	465
920, 921, 940	465
941, 950, 951, 952	465
953, 954, 955	465
1010S, 1010U, 1020	456
1100	465

G. E.

(See General Electric *(U.S.A.)* and General Electric *(CANADIAN)*

GEMBOX

(See Crosley)

GEMCHEST

(See Crosley)

GENERAL (General Television & Radio Corp.)

Model	kc
7, 7-C	456
9	456
9 (auto comb.)	456
10	175
12	175
510	175

GENERAL ELECTRIC (General Electric Co.) *(U. S. A.)*

Model	kc
30	455
35	455
A-51, A-52, A-53, A-54	465
A-55, A-56, A-60	465
A-60 (M32)	175
A-63, A-64, A-65	465
A-66, A-67	465
A-70, A-75	465
A-81 (P31)	175
A-81, A-82, A-83, A-85	465
A-86, A-87, A-88	465
A-90	175
A-125	465
A-205, A-205E, A-206	465
A-208, A-208E	465
B1, B2	175
B-40, B-52	175
B-81, B-86	175
C-41 (auto radio)	175
C-60, C-61 (auto radios)	175
C-62	460
C-67	175
C-70, C-75	460
D-50, D-51 (auto radios)	175
D-52, D-72 (auto radios)	175
E-50, E-51, E-52	465
E-61, E-62, E-68	465
E-71, E-72	465
E-76, E-79	465
E-81, E-86	465
E-91, E-95	465
E-101, E-105, E-106	465
E-115	465
E-126, E-129	465
E-155	465
ED7C, ED7M, ED7T	465
ED8C, ED8M, ED8P, ED8T	465
ED10C, ED10T	465
F-40, F-51	455
F-53	465
F-63, F-65, F-65B, F-66, F70, F-74, F-75	465
F-77, F-80, F-81, F-85	465
F-86, F-88, F-96, F-107	465
F-109, F-135, F-665	465
FA60, FA61 (auto radios)	175
FA80 (auto radio)	175
FB-52, FB-53	465
FB-56, FB-57	465
FB-72, FB-73	465
FB-76, FB-77	465
FD-62, FD-625	465
G-50	465
G-53	455
G-55	455
G-56	455
G-57	465
G-61, G-64, G-65	455
G-66, G-68, G-69	455
G-70, G-75, G-76	455
G-78, G-85, G-86	455
G-95	455
G-97	465
G-99, G-105, G-106	455
GD-51, GD-52	455

(Cont'd over)

GENERAL ELECTRIC
(U. S. A.)—(Cont'd)

Model	kc
GD-52A, GD-60	455
GD-62	465
GD-63	455
GD-67	465
GD-520, GD-521	455
GD-600, GD-610	455
GD-620, GD-630	455
GM-125	455
H-31, H-32	175
H-51, H-51-R	175
H-71, H-71-R	175
H-72	175
H-73, H-77	455
H-78, H-79	455
H-87	455
H-91, H-91-R	175
H-116, H-118, H-500	455
H-500U (W & X incl.)	455
H-501 (W & X incl.)	455
H-502, H-503, H-510	455
H-510U (W & X incl.)	455
H-511, H-520, H-520V	455
H-521 (W & X incl.)	455
H-530, H-531, H-532	455
H-600 (W & X incl.)	455
H-600U (W & X incl.)	455
H-601 (W & X incl.)	455
H-610 (W & X incl.)	455
H-610U (W & X incl.)	455
H-611 (W & X incl.)	455
H-620 (W & X incl.)	455
H-620U (W & X incl.)	455
H-621 (W & X incl.)	455
H-622, H-623, H-625	455
H-630U	455
H-631, H-631U	455
H-632, H-632U	455
H-634, H-638, H-639AC	455
H-639DC, H-640, H-708	455
H-736	455
HB-412, HB-504, HB-505	455
HJ-514, HJ-612, HJ-618AC	455
HJ-618DC, HJ-624, HJ-628	455
HJ-637, HJ-905, HJ-908	455
HJ-908B	455
HJ-1005	455
HJ-1205	455
HM-136 (Freq. Mod.)	2100
("B", "C", & "D" Bands)	455
HM-171 (Telev. Video)	12750
(Telev. Audio)	8250
HM-185 (Telev. Video)	12750
(Telev. Audio)	8250
HM-225 (Telev. Video)	12750
(Telev. Audio)	8250
HM-226-7A	
(Telev. Video)	12750
(Telev. Audio)	8250
(Radio)	455
J-51, J-53, J-54	455
J-54W, J-62, J-63	455
J-64	455
J-70	175
J-71	455
J-72, J-75	175
J-80, J-81, J-82	175
J-83, J-83A	175
J-85, J-86	175
J-87, J-87-A, J-88	175
J-100	175
J-105	455
J-107, J-109	175
J-125, J-125A	175
J-501, J-501W	455
J-502W, J-512	455
J-602, J-603	455
J-614, J-620	455
J-620	455

(Cont'd)

GENERAL ELECTRIC
(U. S. A.)—Cont'd)

Model	kc
J-629, J-644	455
J-644W, J-654	455
J-654W, J-664	455
J-718, J-728	455
J-805, J-808	455
J-809, J-818	455
J-828, J-1106	455
J-1108	455
JB-523, JB-524	455
JB-630, JB-631	455
JFM-90 (tuner)	4300
JFM-165	4300
JZ822, JZ822A, JZ826	175
JZ828, JZ835	175
K-43	460
K-50, K-50P	175
K-51, K-51P	175
K-52, K-53, K-53-M	175
K-54, K-54-P, K-55	175
K-58	175
K-60, K-60-P	175
K-62, K-63	175
K-64, K-64-D	370
K-65, K-65-P	175
K-66, K-66-M	175
K-78, K-79	175
K-80, K-80-X	445
K-82	175
K-85	445
K-88, K-88-X	445
K-105, K-106, K-106-P, K-107	175
K-126	175
KZ-62-P	175
L-50, L-51	175
L-52, L-52A, L-53	175
L-500, L-510, L-512	455
L-513, L-520, L-521	455
L-522	455
L-540, L-541, L-542, L-542M	455
L-543, L-543M, L-550, L-560	455
L-570, L-571, L-572	455
L-573, L-574, L-580, L-600	455
L-601, L-610, L-611	455
L-613, L-621, L-624	455
L-630, L-632, L-633	455
L-640, L-641, L-650, L-651	455
L-652, L-660, L-668, L-679	455
L-740, L-915, L-915W	455
LB-412, LB-424	455
LB-530, LB-530X, LB-700	455
LB-701, LB-702, LB-703	455
LC-619, LC-619W	455
LC-648, LC-648W, LC-758	455
LC-759, LC-759B, LC-768	455
LF-115, LF-116, LFC-1118	455
LFC-1128, LFC-1228	455
M-41, M-42	460
M-49, M-50	460
M-51, M-51A, M-52	460
M-55, M-56	460
M-61, M-62	460
M-63	175
M-65	370
M-66, M-67	460
M-68	370
M-69	460
M-81, M-85, M-86	460
M-89	460
M-106, M-107	460
M-125	460
M-128, M-128-R	175
M-129	460
M-655	460
N-60 (auto radio)	175
RGDS-52	455

(Cont'd)

GENERAL ELECTRIC
(U. S. A.)—(Cont'd)

Model	kc
S-22, S-22A, S-22-D, S-22-X	175
S-42, S-42-B, S-42-D	175
S-132, SZ-42-P	175
U-50	175
U-51, U-55	456
U-70, U-75	456
U-100	456

GENERAL ELECTRIC
(CANADIAN)
(General Electric Co., Ltd.)

Model	kc
A-4B, A-4CB	460
A-6B, A-6CB	460
A-7B, A-7CB	460
A-43, A-44, A-44-X	460
A-50, A-54	460
A-55, A-58	460
A-63, A-64, A-68	460
A-69, A-69Y	460
A-70, A-75	460
A-82, A-87, A-87Y	460
A-108, A-128, A-148	460
B-40, B-52	175
C-41, C-61	175
D-51	175
E-4B, E-4CB	460
E-6B, E-6CB	460
E-50	460
E-53, E-53X	460
E-56, E-56X	460
E-81, E-86	460
E-89, E-98	460
E-106, E-157	460
F4B	460
F5B, F5CB	260
F6B, F6CB	460
F40, F52, F52A	460
F55B, F55CB	460
F57, F57A	460
F62, F66, F71	460
F75, F76, F77	460
F82, F87, F87A	460
F88S, F107	460
F127, F167	460
G4B, G5B, G5CB	460
G6B, G7CB, G40	460
G51, G57	455
G60, G62, G66	455
G71	460
G76, G77, G88K	455
G88X	460
G117, G167	455
H-31, H-32	175
H-51	175
H-71, H-72, H-77	175
J-72, J-76	175
J-82, J-85	175
J-86	175
J-105, J-107, J-125	175
JB-83, JB-87	175
JZ-30	1075
K-8-B, K-8-CB	175
K-50, K-52, K-53	175
K-57, K-59, K-60	175
K-62	175
K-64	370
K-75	175
K-80, K-85	345
K-106, K-126	175
L-6B, L-6CB	460
M-6M2	260
M-7-B, M-7-CB	460

(Cont'd

GENERAL ELECTRIC (CANADIAN)—(Cont'd)

Model	kc
M-41, M-42	460
M-50, M-51, M-52	460
M-55A, M-56, M-58	460
M60, M60-2	260
M-61	460
M-62	460
M-64, M-65	370
M-67	460
M68, M69	260
M-77	175
M-81, M-86	460
M-106, M-107	460
M-125	460
N-51	260
S-S42	175
S-22, S-22A	175
S-22X, S-25	175
S-42A, S-42B	175

GENERAL ELECTRONICS

Model	kc
AW-50	465

GENERAL HOUSEHOLD UTILITIES CO.

(See listings under Grunow)

GENERAL MOTORS CORP. (Day-Fan)

Model	kc
210 (S-1A, S-1B)	175
211	175
216, 217 (S-1A, S-1B)	175
219, 220 (S-1A, S-1B)	175
250 (S-1A, S-1B)	175
251 (S-2A, S-2B)	175
252	175
253	175
254	175
255	175
256	175
257	175
258	175
281	175
292, 293	175

(For listings of later receivers, see United Motors Service)

GENERAL TELEVISION AND RADIO CORP.

(See General)

GILFILLAN (Gilfillan Bros., Inc.)

Model	kc
Petite	460
5 Tube Super (1934-1935)	175
X (auto radio)	460
5	175
5B7, 5B8, 5B9	460
5C, 5D	175
5G8, 5SJ, 5S8	460
5M, 5T	175
5T8	460
5X	450
6C	262.5
6G8	460
6PR	460

(Cont'd)

GILFILLAN—(Cont'd)

Model	kc
6T	262.5
6X8	175
7-A (auto radio)	175
7C8, 7F8, 7T8	460
8-A (auto radio)	262
8APR	460
8C	262.5
8C8, 8C8E	460
8T	262.5
8T8	460
8T8E	460
8X (auto radio)	265
13C8	460
13C8E	460
32, 33A (auto radio)	175
34	450
35	175
41	175
47, 50	262.5
52-A	460
53-A	465
54-A	460
54-S	460
55-A, 55-B	450
56-S	460
60-A (auto radio)	175
62-B, 62-X	175
63-B, 63-X	460
66-S	460
67-A, 67-R (auto radio)	252.5
76A	460
76M, 76S	460
77, 77-A, 77-R (auto radio)	252.5
78-B, 78-X	460
87-R (auto radio)	262.5
96-B, 96-X	460
97-B, 97-X	460
108M	460
110	175
116-B, 116-X	460
117-B, 117-X	460
138M	460
200, 250	175
501T	460
510, 510T	175
515	460
520	175
521T-C	460
615, 625	262.5
711T	175
715, 723T-C, 725	460
731C, 731T, 731T-C	460
815, 825	262.5
831C, 831T, 831T-C	462
1131C, 1331C	462

GLORITONE

(See U. S. Radio & Television Co.)

GOLDENTONE

(See also listings under Fordson)

Model	kc
L5, L6, L7	456
Z4, Z5	456
All 1936-7 models	456

GOLDENVOICE

(See Motorola)

GOODYEAR SERVICE (Wings)

Model	kc
404	465
478 Series A	465
504	465
522, 523-B	465
540	456
550	456
566	465
575	175
585	465
585 Series A	370
585 Series B	370
587	465
588	465
601	465
602	465
602B	470
623	465
661, 666	465
667	262.5
670, 675	175
691	465
741	465
749	456
777 Series AB	465
787	465
881	262.5
888, 889	465
1170-C	465
1171	465
1173, 1174	465
1175	465
01009, 01018	465
01020	262.5
01029	465
01030	465
01500 (auto radio)	456
01501 (auto radio)	262
01502 (auto radio)	465
01503	456
01554	465
010211	465
010219	465
010220	465
010221	465
010222	465
015050	455
015060	455
015070	455
015080	455
015090	455
015100	455
015110	455
015120	455
015130	455
100502	465
101500	456
101501	262
101503	456
103533	455

GOODYEAR TIRE & RUBBER CO. INC.

(See Goodyear Service)

GRAHAM-PAIGE MOTORS

(See also United Motors Service. Also see Graham-Paige Models listed under Philco)

Model	kc
G-1418, G-1436	260
G-1528	260

GRAYBAR ELECTRIC CO.

Model	kc
GB-8, GB-8-A	175
GB-9	175
GB-100	175
GB-300, 340	180
GB-600	175
GB-700, GB-770	175
GB-900	175
GB-989	175
GC-13	175
GC-14, GC-15	175
GT-7, GT-8	175
GT-8-56	175
GT-8-69	175
GT-10-69	175
GT-10-88	175
GT-10-99	175
340	180
600	175

GREBE
(Grebe Mfg. Co. Inc.)

(Garod, Grebe, Synchrophase. See also listings under Garod)

Model	kc
Challenger I	456
Challenger II	456
Teeny 2	456
Teeny 3	456
Teeny 4	456
Teeny 5	456
B-37	456
HS-3, HS-4 (all), HS-5	175
HS-6, HS-7, HS-8	175
HS-11, HS-12	175
R18-399, R18-1039	456
R20-4159	456
2B2-I, 2B2-L, 2B2-T	456
2B6-I, 2B6-L, 2B6-T	456
3B2-L, 3B2-T, 3B2-3	456
3B6-L, 3B6-T, 3B6-3	456
61-R	456
89	175
111B	175
159	456
206-I	456
206-L	456
250	456
259, 269	456
307-I, 307-L, 307-P5, 307-T	456
309-EL, 309-ET, 309-E2	456
309-L, 309-P5, 309-T, 309-2	456
360, 361	456
369, 369G	456
369-P10, 369-P16	456
369-T	456
370, 370C, 370D, 370KC	456
371, 371C, 371D, 371KC	456
379, 379-B	456
379-P10, 379-P16	456
379-W	456
380, 380D, 380KC	456
381, 381D, 381KC	456
399, 399-C	456
399-P12, 399-P14	456
399-P18, 399-P20	456
399-S, 399-W	456
619, 619-C	456
620	456
629	456
703-L	456

(Cont'd)

GREBE—(Cont'd)

Model	kc
729	456
730, 731	456
739, 739-G, 739-T	456
769	456
803-I, 803-L, 803-P5, 803-T	456
830, 830A, 830C, 830D, 830KC	456
831, 831A, 831C	456
831D, 831KC	456
839, 839-B	456
839-P10, 839-P16	456
839-W	456
903-EL, 903-ET, 903-E2	456
903-L, 903-P5, 903-T, 903-2	456
930, 930A, 930D, 930KC	456
931, 931D, 931KC	456
939	456
1039, 1039-C	456
1039-P12, 1039-P14	456
1039-P18, 1039-P20	456
1039-S, 1039-W	456
1049	456
1203-L, 1203-P6, 1203-P6A	456
1203-T, 1203-3	456
1204-EL, 1204-ET, 1204-E3	456
1240, 1240A	456
1240E, 1240LC	456
1603-P6, 1603-P6A, 1603-4	456
1604-E4	456
1649	456
1649-P12, 1649-P14	456
1649-P18, 1649-P20	456
1649-S	456
1650, 1650A	456
1650H, 1650LC	456
1739 (Batt. Set)	456
2050	456
3012-L, 3012-P6, 3012-P6A	456
3012-T, 3012-3	456
3016	456
3016-P6, 3016-P6A, 3016-4	456
3119-K	456
3790	456
4012-EL, 4012-ET, 4012-E3	456
4016-E4	456
4110, 4110E, 4110KC, 4110LC	456
4159	456
4159-P12, 4159-P14	456
4159-P18, 4159-P20	456
4159-S	456
5140, 5140H, 5140LC	456
5240, 5240-4	456
7090	456
7390, 7390-T	456

GRIGSBY-GRUNOW
(See listings under Majestic)

GRUNOW
(General Household Utilities Co.)

Model	kc
2A (remote control unit for 9B)	262
4A, 4B	455
4C	465 or 490*
4NB	465
5A, 5B	455
5C, 5D	455
5E	455
5G	465 or 490*
5H, 5J	465
5K, 5L	465
5NB	465

(Cont'd)

GRUNOW—(Cont'd)

Model	kc
5Q	465
5R, 5S	465
6A, 6C	262
6D, 6F	455
6G	465 or 490*
6HB	465
6J	465 or 490*
6M	465
7A, 7B	262
7C	455
7DB	465
7M	465
7NB	455
8A, 8B	262
8D, 8E	455
8H	455
9A	262
9B (and remote control unit 2A)	262
9C	262
9E	455
11A, 11B	262
11C	455
11G	465
12A	455
12B, 12W	465
15W	455
410, 411	465
450, 451 (chassis 4A)	455
460, 461 (chassis 4B)	455
470 (chassis 4C)	465 or 490*
500 (chassis 5A)	455
501 (chassis 5B)	455
502 (chassis 5C)	455
503 (chassis 5C)	455
508, 509	465
510 (chassis 5NB)	465
520 (chassis 5B)	455
530 (chassis 5B)	455
532 (chassis 5H)	465
542 (chassis 5J), 544, 545	465
550 (chassis 5B)	455
551, 553 (chassis 5K)	465
555 (chassis 5L)	465
560 (chassis 5E)	455
564 (chassis 5R)	465
566 (chassis 5S)	465
570, 571 (chassis 5D)	455
572 (chassis 5L)	465
573 (chassis 5Q)	465
576, 578 (chassis 5T)	465
580, 581 (chassis 5G)	465 or 490*
583, 585, 585 (chassis 5W)	465
586, 587, 588, 589, 589 (chassis 5U)	465
590 (chassis 5M)	465
592, 594, 594 (chassis 5N)	465
599, 599 (chassis 5P)	465
614, 618 (auto radios)	262
620, 621 (chassis 6HB)	465
622, 622 (chassis 6B)	465
623, 623 (chassis 6K)	465
624, 624 (chassis 6Q)	465
625 (auto radio)	262
627, 627 (chassis 6K)	465
631 (chassis 6M)	465
632, 632 (chassis 6H)	465
640, 641 (chassis 6J)	465 or 490*
643 (chassis 6M)	465
650, 651 (chassis 6A)	262
654, 654 (chassis 6N)	465
660, 661, 662 (chassis 6C)	262
663, 663 (chassis 6E)	465
670, 671 (chassis 6D)	455
680, 681 (chassis 6G)	465 or 490*

(Cont'd)

GRUNOW—(Cont'd)

Model	kc
690, 691 (chassis 6F)	455
700, 701 (chassis 7A)	262
711	455
720, 721 (chassis 7DB)	465
721, 723 (chassis 7M)	465
731, 733, 735 (chassis 7M)	465
750, 751, 752 (chassis 7B)	262
753 (chassis 7B)	262
755 (chassis 7Q)	465
760, 761	455
801 (chassis 8A)	262
821 (chassis 8B)	262
823 (chassis 8H)	455
831, 833, 835 (chassis 8H)	455
861 (chassis 8D)	455
871 (chassis 8E)	455
901, 902 (chassis 9A)	262
921 (chassis 9C)	262
941 (chassis 9E)	455
1067 (chassis 10D)	465
1081, 1091 (chassis 10G)	465
1101 (chassis 9A-2B)	262
1151, 1152 (chassis 11A and 11B)	262
1161, 1162 (chassis 11A and 11B)	262
1171 (chassis 11C)	455
1181 (chassis 11H), 1183, 1185	465
1191, 1191B (chassis 11G)	465
1241 (chassis 12A)	455
1291 (chassis 12B), 1293	465
1297 (chassis 12W)	465
1541 (chassis 15W), 1561	455

• If local code interference is about 455 kc, the i-f is 490 kc. If it is about 500 kc, the i-f is 465 kc. The correct i-f is stamped on the chassis.

GULBRANSEN
(Gulbransen Radio Co.)

(Also see Wells-Gardner & Co.)

Model	kc
05A	262
06W	262
062, 062A	262
092	175
T6W1	262
V6Z2, Z6Z1	262
10 Series, 13	175
20, 23	175
53, 53AC, 92	175
93	175
135, 200	175
235, 236, 237	175
322	175
351	262
352, 362	262
392	175
530, 535	175
372	175
925	175
3225, 3226	175
3521	175
3525	262
3622, 3622-A	262
3722-A	262
3925	175
3726	175

HALLICRAFTERS
(Hallicrafters, Skyrider)

Model	kc
Super Skyrider (25,000-540 Kc tuning range)	465
Super Skyrider (25,000-1500 Kc tuning range)	465
Super Skyrider (43,000-1500 Kc tuning range)	465
DD1	455
H8PA	465
S4, S5, S6, S7	465
S8A, S9, SK9	465
S10	1600
S11 (Super Skyrider)	465
S12 (Commercial Skyrider)	1600
S14 (Sky Chief)	465
S15 (Sky Challenger)	465
S16 (1938 Super)	465
S17	465
S18 (Sky Challenger)	465
S19 (1938 Sky Buddy)	455
S19-R (Sky Buddy)	455
S20 (Sky Champion)	455
S21 (5-10)	1600
S22 (Sky Marine)	1600
S-27	
(Amp. Mod.)	5250
(Freq. Mod.)	5250
S-31 (tuner)	
(Amp. Mod.)	455
(Freq. Mod.)	4300
SX16, SX17, SX18	465
SX24 (Sky Rider Defiant)	455
ST (Sky Buddy)	465

HALSON
(Halson Radio & Television, Inc.)

Model	kc
Roadmaster	456
A5S	456
AW6	456
C6	456
CW6	456
CW7, CW8	456
CW11	456
MA53, MA63	456
MS6	456
NS50	456
NS60	262
S5	456
6L6	456
10, 10X	456
15	456
20	456
20A, 20B, 20X	456
25	456
30, 30X	456
35	456
40, 40A-1	456
40B2X	456
40X	456
50M, 50R, 50RL	456
50S, 50V	456
50X	456
53C	456
56U	456
60L, 60M	456
66AW	456
72, 75, 78	456
100, 100M, 101	456
102, 103	456
104, 106, 161, 162	456
163	456

(Cont'd)

HALSON—(Cont'd)

Model	kc
310	456
412	456
438	456
505	456
520, 530	456
535, 536, 540	456
560	456
570, 580	456
606	456
610, 612, 620, 630	456
711	456
770AW	456
1200	456
1500, 1900	456

HAMMARLUND
(Hammarlund Mf'g. Co.)
(Comet, Pro, Super-Pro)

Model	kc
Comet All-Wave	465
Comet, Dec. '31	465
Comet, July '32	465
Comet Pro	465
HQ-120	455
HQ-120X	455
Super Pro (all models)	465
SP-110, SP-110-L, SP-110-LX	465
SP-110-S, SP-110-SX, SP-110-X	465
SP-120, SP-120-L, SP-120-LX	465
SP-120-S, SP-120-SX, SP-120-X	465
SPR-110, SPR-110-L, SPR-110-LX	465
SPR-110-S, SPR-110-SX, SPR-110-X	465
SPR-120, SPR-120-L, SPR-120-LX	465
SPR-120-S, SPR-120-SX, SPR-120-X	465

HARLEY-DAVIDSON
(Harley-Davidson Motor Co.)

Model	kc
MI-7815 (for police use)	260
YA-1936 (for police use)	456
ZA-1937 (for police use)	456

HARRIS
(Harris Mf'g. Co.)
(Also Electrotone)

Model	kc
500, 501W	465
600	465
700, 701W	465
1201W	465

HATRY & YOUNG

Model	kc
HY-7, HY-7B	1450 to 1750*
HY Short wave 6	1450 to 1750*

*Exact i-f varies with different individual receivers.

HETRO
(Hetro-Electrical Industries, Inc.)

Model	kc
F5, F6, F7, F8	456
F9, F10, F11, F12 (Series FA)	456
F13-F-28 Incl. (Series FA)	456
H47, H48	465
H61, H62	456
HP61, HP62	456
H63, HP63	456
H64, HP64	456
HA67	465
H85, HP85	456
H87, HP87	456
H93, HP93	456
6LB, 6SB	456
6TAC, 6TAC-DC	456
8 tube superhet.	456
9 tube superhet.	456
22	115
31	175
71	456
207, 209	456
257, 259	456
295, 297	456
412, 466	456
10310, 10410	456
10510, 10610	456
11010, 11110	456
11210	456
11710	456
14500, 14510	465
14541, 14551, 14561	456
14610, 14710	456
14810, 14910	456
15010, 15110	456
15210	465
15506, 15566	465
15710	465
16010, 16666	465
18060, 18262, 18810	465
18820, 18830	456
20110	465

HIGH-FREQUENCY LABS.
(Also see Republic Industries)

Model	kc
Skyhawk	175
9-in-line	175
117-4	175

HOBBS
(See Mission Bell Radio Mfg. Co.)

HOODWIN
(Charles Hoodwin Co.)
(Aero, Hoodwin)

Model	kc
International Aero	485
6-Tube Batt.	175
6-Tube DC	175
245	175
261	175
263	265
970	175

HERBERT H. HORN MF'G. CO.
(See listings under Tiffany Tone)

HOWARD
(Howard Radio Co.)
(Cable-Nelson)

Model	kc
Grand	465
Howard "Highwayman"	175
A (S-W Converter)	680
AP	175
AVH (45, 60)	175
AVO (35A)	175
B-13	456
C-14	456
CC-23, CC-24, CC-100	456
D-8, D-15, D-16	465
D-101(D), D-102(D)	465
DL	175
E5B	465
E-14	456
E-57(E), E-107(E)	456
E218, E256, E259, E268	465
EX	140
F	465
F-17, F-18	456
H	175
HA-1 (auto radio)	175
HA-2, HA-3	456
HA-4	175
HA-6 (auto radio), HA-6-1, HA-6-2	465
HA-7, HA-8, HA-9 (auto radios)	262
HA10	465
J-2, J-3(J)	456
K	175
L, M, O	175
Q	170
R-6, R-9(R)	465
S-2	175
S-3	456
S-7	175
S225, S250, S256	465
S259, S260	465
V-11	135
W, W-6	465
W-18, W-19	465
X-2, X-3, X-8	175
X275	465
Y-3	175
Z-4, Z-8	175
1 (auto radio)	465
4B, 4BT	465
5-3	456
5B, 5BT	465
6A(T), 6B	465
6BA, 6BT	465
7BT, 8A (T)	465
20(O), 25(O)	175
30(O), 32(O)	175
35(H), 35-A(AVO)	175
40(H), 45(AVH)	175
52	456
56	465
57A(57), 57-AU(57)	456
57-AUS(57), 57-SW(57)	456
58, 58A (58)	465
58B (58), 59	465
60, 60-SW(60)	456
60(AVH)	175
67	465
67C(67), 67LW(67), 67T(67)	456
68C(68), 68CA(68)	465
68T(68), 68TA(68), 68TB(68)	465
77, 77C(77), 77LW(77), 77T(77)	465

(Cont'd)

HOWARD—(Cont'd)

Model	kc
88C, 88T	465
99, 99C(99),99LW(99), 99T(99)	465
118	465
214, 214E	465
218, 220, 221	465
225, S225	465
240, 240-1	465
240-2, 250, S250	465
256, S256	465
259, S259	465
260, S260	465
266, 268	465
270, 271, 275	465
275-C, 275-T	465
280, 285	465
300, 300A, 301	465
301APC, 302APC	465
302S, 302R	465
302RZ	465
303, 304	465
305, 307	465
308APC, 308C	465
308TT	465
318, 318-D	465
325, 325-D	465
368, 375	465
377	262
400, 400A	465
400(K), 410(L)	175
418	465
420, 420-L, 420(M)	175
425, 425A	465
430 (Series 2)	465
438	465
440 (Series 1, 2)	465
450-A	465 and 1560
468, 480	465
500, 501 (DL)	175
502	456
518, 518S	465
518APC	465
520APC	465
525	465
565, 568	465
568R, 575	465
580, 580C	465
580APC	465
626	465
670A	175
1626, 1627	465

HUDSON
(Hudson Motor Car Co.)

Model	kc
CB6	260
DB37, DB38	260
H-6	260
SA37, SA38	260
SA40	455
650-HD, 651-HE	252
660-TD, 661-TE	252
680	252

HUDSON-ROSS
(Hudson-Ross Co.)

Model	kc
59	456
69	456
80	456

HUPMOBILE-PHILCO
Receivers
(Hupmobile Motor Car Corp.)

Model	kc
G, Hupmobile J, T, W Cars	260
G (122), Hupmobile J, T, W Cars	260
H, Hupmobile J, T, W Cars	260
H (122), Hupmobile J, T, W Cars	260
R, Hupmobile J, T, W Cars	260

ICA EXPORT CORP.
(See Insuline Corp. of America)

IMPERIAL
(See Triangle Electric Co.)

INSULINE CORP. OF AMERICA
(Also Ica Export Corp.)

Model	kc
Aiglon	132
Americus	132
Atlantic	132
AVC Super Six	175
AVC Super Six LW	115
AVC Super Seven LW	115
Bijou	132
Classic	132
Elite	132
Envoyette	132
Gnome	132
Hy Power No. 450	470
Ica-ette	456
ICA Six Midget (all)	462.5
ICA Six No. 210	470
ICA Six No. 250	470
Latinic	132
Magicolor (all)	462.5
Mignon	132
Pacific	132
Super Seven	175
Super Six, AVC	132
Super Six Broadcast	175
Super Conqueror	175
Super Six Long Wave	115
Super Seven	175
Super Seven Long Wave	115
Superba	470
Superhet. (6TAC)	175
Superhet. (7T220 VDC)	175
Transatlantic Console	1580
Transatlantic Midget	1580
Transatlantic Phono Comb.	1580
Transpacific Console	1580
Transpacific Midget	1580
Transpacific Phono Comb. Console	1580
Ultra No. 1000	470
Ultra No. 1050	470
Una Fives: (including)	
Atlantic	132
Bijou	132
Gnome	132
Pacific	132
Uni-9	115
Universal No. 550	470

INTERNATIONAL
(International Radio Corp.)
(International Industries, Inc.)
(Kadette & International)

Model	kc
Classic	448
A	262.5
A-4, A-5, A-6	262.5
A-7, A-8, A-9, A-10	262.5
A, B, Kadette	262.5
AB-9, AB-10	262.5
AD-11, AD-12	262.5
AW-55	445
B	262.5
B-1, B-2, B-3	262.5
BW	262.5
CB, CD, CM, CMS	175
CS	175
D	262.5
D-11, D-12, D-14	262.5
DA-8, DA-9, DA-10	262.5
DAC, DAS, DSP	262.5
EL-105	456
ES, ES-19, ES-20	262.5
ES-25	262.5
J, JS	175
K-6	262.5
K10, K11, K12, K13	448
K14, K15, K16	448
K25, K26, K27, K28	448
K-60	262.5
K150, K151	448
K617, K630, K634	448
K739, K1019	448
K1129, K1140	448
K1149, K1159	448
KR20	448
KS	175
L	448
20	448
35, 36	448
52, 53, 56X	448
60	262
61	448
65	262
66, 66X	448
70	262
71, 71C	456
72, 77	448
80	262
85 (Serial No. 5950)	456
85 (Serial No. 5951)	262
85 (Serial No. 6500)	456
85 (Serial No. 6501)	262
85 (Serial No. 185498)	456
85 (Serial No. 185499)	262
86, 86X	448
87 Series	448
90 (Serial No. 6500)	456
90 (Serial No. 6501)	262
96	448
105	456
120	448
150, 151	448
400 Series	448
500, 553	448
617	448
630, 634, 635, 649X	448
661, 666, 676	448
681	448
735, 739	448
777, 778, 779	448
781, 845	448
950, 1019	448
1030, 1035	448
1050	456
1129, 1140	448
1149, 1159	448
1200, 2200	448
3734	448

INTEROCEAN
(Interocean Radio Corp.)

Model	kc
202	456
500	175
505	456
508	456
511	456
515, 517	175
520, 521 (chassis 2035)	175
522, 524, 525	456
525A, 527, 527A	456
530, 531, 533 (chassis 2038)	175

JACKSON BELL
(Jackson- Bell Co., Lt'd.)

Model	kc
24	456
25, 25A, 25U	175
26S	175
26SBL	465
27, 28, 29	175
33	840
79	175
84, 86, 87, 88	175
89, 89-A	175
99	175
205 (auto radio)	465

NOTE: For late Jackson Bell receivers, see listings under Pacific Radio Corp. of Los Angeles, Cal.)

JACKSON RESEARCH
(Jackson Research Labs.)

Model	kc
NJ-8	175

JEWELBOX
(See Crosley)

KADETTE
(See listings under International)
(International Industries, Inc.)

KARADIO
(Karadio Corp.)

Model	kc
F-6 (Ford Special) (auto radio)	456
7S7 (Sheriff)	456
50	465
55P (Police)	456
56	456
57 (Sheriff)	456
57, 57B, 57S	456
65	456
66 7-Tube	456
67-S	456

(Cont'd over)

KARADIO—*(Cont'd)*

Model	kc
75, 76, 77 (auto radios)	456
77-X, 78 (auto radio)	456
88 8-Tube	262
150	456
160, 180	456
667 (Farmsette)	175

KAYO
(Kayo Mf'g. Co.)

Model	kc
Super 4	175
Super 5	262.5

(KELLER-FULLER MF'G. CO., LT'D.)
(Keller-Fuller, Radiette)

Model	kc
50S	175
70, 80, 90	175
120	175
Radiette 70	175

KENNEDY
(Colin B. Kennedy Corp.)

Model	kc
52	175
52 Export	135
53-SW	1,000
54	1,525
54-SW, 54-A-SW	1,000
56	175
62 (all)	175
63, 63-A	175
64 (all), 66 (all)	175
67 Export	110
72, 72-A, 72-B	175
164-B	175
266-B	175
366-B	175
563-A, 563-B	175
826-B	175
882-62-D	175
882-64C	175

KINGSTON
(Kingston Products Corp.)
(See also Coronado and Gamble-Skogmo)

Model	kc
Gypsy Model 5-T (AC-DC)	456
55	456
500, 500-A	456
600-A, 600-B, 610-B (all chassis under C-1100)	182.5
600-A, 600-B, 610-B (all chassis above C-1100)	172.5
690-B	456
700	456
700-A, 700-B	456
715-B	456

KNIGHT
(Allied Radio Corp.)
(Knight, Roamer)

Model	kc
Audiola	175
Knight 6 tube	175
Knight 7 tube	175
Knight 12 tube	177.5
Knight 118 AVC	175
Knight E-9830	177.5
Knight E-9831	177.5
10 Tube	177.5
12 Tube Class	177.5
A6 (Auto)	177.5
A31F	456
A-47HS, A-56	456
A-60, A-60B, A-71	456
A-81	465
A-128	456
A-228	456
A-321, A-681	465
A-3281	456
A-6372	465
A-9700	465
A-9705	456
A-9707	465
A-9710, A-9710E	465
A-9711, A-9711E	465
A-9712, A-9712E, A-9720	465
A-9721, A-9722	465
A-9724, A-9725	465
A-9726, A-9728	465
A-9729, A-9730	465
A-9733, A-9734	465
A-9735, A-9741	465
A-9744, A-9745	465
A-9746, A-9750	465
A-9752, A-9753	465
A-9754, A-9755	465
A-9757, A-9758	465
A-9760, A-9761	465
A-9762, A-9764	465
A-9765, A-9766	465
A-9768, A-9769	465
A-9770	465
A-9775, A-9776	456
A-9777, A-9778	456
A-9780 (auto radio)	175
A-9781 (auto radio)	175
A-9782, A-9783 (auto radios)	175
A-9784 (auto radio)	175
A-9785, A-9786	456
A-9788, A-9789	456
A-9790	456
A-9801, A-9801E	465
A-9802	456
A-9805	465
A-9805E, A-9806	465
A-9806E, A-9807	465
A-9807E, A-9808	465
A-9808E, A-9809	465
A-9810, A-9811	465
A-9812, A-9813	465
A-9814, A-9815	465
A-9820	262
A-9821 (auto radio)	456
A-9826, A-9828	465
A-9830, A-9831	465
A-9833, A-9834	465
A-9835, A-9836	465
A-9837, A-9838	465
A-9839, A-9840	465
A-9841, A-9842	465
A-9848, A-9849	465
A-9851, A-9852	456
A-9852E, A-9853	456
A-9854, A-9854E	456
A-9855, A-9856	456
A-9857, A-9857E	456

(Cont'd)

KNIGHT—*(Cont'd)*

Model	kc
A-9860, A-9861	456
A-9862, A-9863	456
A-9864, A-9865	456
A-9866, A-9870	456
A-9871, A-9872	456
A-9875, A-9876	456
A-9880	175
A-9882	456
A-9883, A-9884	456
A-9885, A-9886	456
A-9887, A-9890	456
A-9891	456
A-10500, A-10501	456
A-10502, A-10503	456
A-10505, A-10506	456
A-10507, A-10508	456
A-10510, A-10511	456
A-10512, A-10513, A-10515	456
A-10616, A-10517	456
A-10518, A-10520	456
A-10521, A-10522	456
A-10523	456
A-10531, A-10532	465
AA	456
AM3, AM4, AM7, AM8	456
AZ-2, AZ-3	456
AZ-4, AZ-5	456
AZ-282, AZ-347, AZ-482	456
BAC	175
B Super	177.5
B6, B7, B8 (auto radios)	456
B17, B18	175
B-101 (auto radio)	456
B-102	175 or 262
B-102 (auto radio)	177.5
B-127, B-227	456
B-660 (auto)	175
B-770 (auto)	175
B-780 (auto)	175
B-880	175
B-10500	465
B-10501	456
B-10508	456
B-10510	465
B-10511, B-10512	465
B-10514, B-10515	465
B-10616, B-10517	465
B-10518	465
B-10520, B-10521	456
B-10522	465
B-10525, B-10526, B-10527	465
B-10529, B-10530	456
B-10531, B-10533	456
B-10534, B-10535	456
B-10536, B-10537	456
B-10538, B-10539	456
B-10540, B-10541	456
B-10542, B-10543	456
B-10544, B-10545	456
B-10546, B-10547	456
B-10548, B-10549	456
B-10550, B-10551 (auto radios)	175
B-10552 (auto radio)	175
B-10553	456
B-10560, B-10561	465
B-10562, B-10563	465
B-10565, B-10566	465
B-10567, B-10568	465
B-10570, B-10572	465
B-10575, B-10577	465
B-10578, B-10579	465
B-10580, B-10581	465
B-10582, B-10585	465
B-10586, B-10588	465
B-10589, B-10590	465
B-10591, B-10592	465
B-10593, B-10595	465

(Cont'd)

KNIGHT—(Cont'd)

Model	kc
B-10596, B-10600	465
B-10601, B-10602	465
B-10603, B-10604	465
B-10605, B-10606	465
B-10607, B-10608	465
B-10609, B-10610	465
B-10611, B-10612	465
B-10615, B-10617	465
B-10620, B-10621	465
B-10625, B-10626	465
B-10627	465
B-10702, B-10703	465
B-10704, B-10705	465
B-10706, B-10707	465
B-10708, B-10709	465
B-10710, B-10711	465
B-10712, B-10713	465
B-10714, B-10715	465
B-10716, B-10717	465
B-10718, B-10719	465
B-10723, B-10724	465
B-10725, B-10726	465
B-10727, B-10728	465
B-10729, B-10730	465
B-10731, B-10732	465
B-10733, B-10735	465
B-10737, B-10738	465
B-10739, B-10740	465
B-10741, B-10742	465
B-10743, B-10744	465
B-10745, B-10746	465
B-10747, B-10748	465
B-10749	465
B-10750	456
B-10751, B-10752	456
B-10753, B-10754	456
B-10760, B-10761, B-10762	456
B-10765, B-10766	456
B-10767	456
B-10770, B-10771	456
B-10773, B-10775	456
B-10776, B-10777	456
B-10778, B-10779	456
B-10780, B-10781	456
B-10782, B-10784	456
B-10786, B-10790 (auto radio)	456
B-10791 (auto radio)	175
B-10793, B-10794	456
CL-5, CL-6	456
CL-583, CL-684	456
C-101	456
D-15	465
D-16	465
D-9530, D-9531, D-9532	175
D-9533, D-9534, D-9535	175
D-9550, D-9551, D-9552, D-9553	175
D-9554, D-9555, D-9556, D-9557	175
D-9570, D-9571, D-9572	175
D-9573, D-9574, D-9575	175
D-0150X	456
E-9501, E-9507, E-9511, E-9513, E-9521	175
E-9527, E-9529	456
E-9710, E-9711, E-9712, E-9713	175
E-9721, E-9723, E-9725	175
E-9727, E-9729	456
E-9730, E-9731, E-9732	177.5
E-9733, E-9734, E-9735	177.5
E-9740, E-9741, E-9742, E-9743	177.5
E-9744, E-9745, E-9746, E-9747	177.5

(Cont'd)

KNIGHT—(Cont'd)

Model	kc
E-9750, E-9751, E-9752, E-9753	177.5
E-9754, E-9755, E-9756, E-9757	177.5
E-9760, E-9761, E-9762, E-9763	175
E-9764, E-9765, E-9766, E-9767	175
E-9824, E-9825	175
E-9830, E-9831	177.5
E-9905	175
"F"-W	456
F-9501, F-9503, F-9505, F-9507, F-9509	456
F-9511, F-9513, F-9515	456
F-9531, F-9533, F-9535	456
F-9541	175
F-9551, F-9553 (auto radios)	456
F-9561, F-9563 (auto radios)	177.5
F-9565	456
F-9566, F-9567	175
F-9569, F-9571, F-9573	456
F-9576, F-9577, F-9579, F-9580, F-9581, F-9583	175
F-9585, F-9587	175
F-9589, F-9591, F-9593, F-9595	456
F-9610, F-9611, F-9612, F-9613	175
F-9616, F-9617, F-9618, F-9619	175
F-9631	456
F-9640, F-9641, F-9642, F-9643	177.5
F-9644, F-9645, F-9646, F-9647	177.5
F-9650, F-9651, F-9652, F-9653	177.5
F-9660, F-9661, F-9662, F-9663	177.5
F-9664, F-9665, F-9666, F-9667	177.5
F-9670, F-9671, F-9672, F-9673	177.5
F-9685, F-9687	177.5
F-9737, F-9741	177.5
F-9745, F-9747 (auto radios)	252.5
F-9751	456
G-9511, G-9513	456
G-9515	456
G-9517	175
G-9521, G-9525, G-9527	456
G-9531	456
G-9533, G-9545, G-9547, G-9549	465
G-9553, G-9557	456
G-9561A, G-9561B	465
G-9563, G-9565, G-9567	465
G-9571, G-9573	465
G-9575, G-9577, G-9579, G-9581	456
G-9583, G-9585, G-9591, G-9593	456
G-9595	456
G-9599 (auto radio)	456
G-9611, G-9613, G-9615	456
G-9616, G-9621, G-9623	465
G-9629, G-9631, G-9633, G-9635, G-9637, G-9639	465
G-9643, G-9645	465
G-9851, G-9853, G-9855	456
G-9858M, G-9861, G-9863, G-9865	456
G-9869, G-9870, G-9871, G-9873, G-9874	456
G-9875, G-9876	465

(Cont'd)

KNIGHT—(Cont'd)

Model	kc
G-9881	456
G-9882	175
G-9885, G-9889, G-9890	465
G-9891, G-9892	465
G-9895, G-9896, G-9898	456
"G"-W	456
H-9701	456
H-9706, H-9707, H-9708	465
H-9711	456
H-9715, H-9716, H-9717, H-9718	465
H-9725	456
H-9726	175
H-9730, H-9732, H-9733	456
H-9741, H-9742, H-9744, H-9745, H-9747, H-9748	456
H-9751, H-9752, H-9754, H-9755, H-9756, H-9758, H-9759	456
H-9761, H-9765	456
H-9766 (auto radio)	456
H-9773, H-9774	465
H-9776, H-9777, H-9779	456
H-9780, H-9781, H-9782	456
H-9791, H-9792	456
H-9805	465
H-9811 (auto radio)	456
H-9812 (auto radio)	175
H-9813, H-9815	456
H-9817, H-9818, H-9819, H-9820, H-9822	465
H-9830, H-9831, H-9832, H-9834, H-9835, H-9836, H-9837	456
H-9840, H-9841, H-9842	456
H-9845	465
H-9850, H-9852, H-9853, H-9854, H-9855, H-9856, H-9858	456
H-9861, H-9865, H-9867, H-9873, H-9874	465
H-9880, H-9882, H-9883, H-9884, H-9885, H-9886	465
H-9891, H-9893	465
H-9897 (auto radio)	252.5
L-4, L-5, L-7	456
L-477, L-481, L-567	456
L-668	456
L-767, L-783	456
M1, M5	456
M-169, M-451	456
M-551, M-557	456
ML-2, ML-4	456
ML-215A, ML-266	456
ML-477, ML-481	456
P, P-AC (1933 Model)	175
P-AC (1934 Model)	175
P-Batt.	456
P-DC	175
P-F	465
P-15H2	465
P-15M3	465
P-15X1	465
P-32	456
P-200, P-200M3	465
S7	177.5
SA-120, SW-88, SW-89	175
T (auto radio)	456
T (auto radio)	175
U, U-6 (auto radio)	456
U6B	456
US (auto radio), U-UE	456
X-6, X-8	456
X112	465
X-541, X-641	456
X-718, X-813	456
Z2, Z3, Z5	456
Z-242, Z-442	456

(Cont'd over)

KNIGHT—*(Cont'd)*

Model	kc
Z-547	456
1P12EM2	465
3S3	465
4H1, 4H4, 4T	465
5-T (auto)	175
6A60, 8K	456
6-A	456
6A55	456
6P	456
6-21-M1	456
7S34	455
7T (auto)	456
8K	456
8S33	177.5
8T, 9G, 9GA	456
10S33	177.5
11AC-161	465
11S, 11SA	456
11S3	456
12EH1, 12EN1	465
12S33	177.5
14A72	465
14A90	465
15, 15H2, 15H3, 15X1	465
16R	456
17, 18	175
19A-68	465
21A	456
23S8, 23S10, 23S12	177.5
30A-99	175
30M, 30MB3	465
30N3, 31-W9	465
35H1, 35W8	465
35XW7	465
36H6, 36R1, 36W2	465
37B71	465
39B, 39B-71, 39B-77	465
39B-80X, 39B-81	465
40H7, 40-41	465
40M, 40MB1	465
41PB-R1	465
41PB-W2	465
41W6	465
42H1, 42W5	465
43W1, 43W10	465
46A, 46A-95	465
46A-106, 46A-108	465
46A149, 46AE	465
46ACE140	465
46ATE15	465
47A-72, 47A-90	465
47ACE	465
47A72	465
47A105	465
47ATE	465
50C3, 51MC4	465
52AE, 52ACE136	465
54N3	465
55 (auto)	456
60B, 60BC, 60BC136	465
60BT164, 60BX144	465
60M, 60MF1	465
61-88	465
65-BC, 65-BT	465
66B, 66BCE, 66BTE	465
68B	465
68BE, 68BCE140	456
68BTE151	456
68CA, 68TC	456
70, 72A, 72A165	465
72AE, 72AT181	465
72ATE166, 72ATE184	465
75B, 75B136	465
75BT132, 76A	465
76AC161, 76AT121	465
78BE, 78BCE178	465
78BTE121	465
78BTE178	465
78BTE121	465

(Cont'd)

KNIGHT—*(Cont'd)*

Model	kc
80, 80 (AC)	465
80 Batt.	465
80CE, 80BT168	465
80BT185, 82AC182	465
82ACE182, 82ATE183A	465
82AE, 86A, 86ACE178	465
86AE, 86ATE189	465
88BCE, 88BCE178	465
88BE, 88BTE196	465
90, 9AW, 90CE	456
93L, 93LC136	465
93LT183, 95B, 95BC	465
95BT186	465
98AE, 98ATE184	465
99B, 99T	465
100, 100X184	465
101 (auto radio, 1935 model)	175
101 (auto radio, 1936 model)	456
102 (auto radio, 1935 model)	252.5
102 (auto radio, 1936 model)	175
106A	465
107ATE175	465
114, 118	175
150	465
150-75	465
150-6Y, 150-5Z	456
155CX, 155-64	456
160-5M	456
165-6W	456
170-6A	456
170-6P, 170-7M, 171X	456
175-8K	456
185, 185-6A, 185-6P	456
189-GA, 189-9G	456
190, 190-8K	456
195-11S	456
200-16R	456
205-6Q	456
264	175
320	456
320-83, 321	465
321-TM2-811	465
371A, 381A	456
412	456
462 (auto radio)	252.5
462S	262.5
480	465
501, 502-6B	456
503-6B	456
505SW	177.5
510-6B	456
511-8B	456
512, 512-6D	456
513-5A, 514-5A, 515-5A	456
563, 599	265
599	175
633	465
666AX (auto radio)	252.5
680, 680-T, 680-47	465
680-71, 681	465
724, 810, 810-32	175
3280, 3280-T	465
3280-47, 3280-71	465
3281A	456
4052, 4053-M2	465
5003	465
5646	456
6055	465
6246	465
6246B	456
6322, 6370	465
6370-A	456
6370-T	465
6370-72M, 6370-82M	465
6753B	465

(Cont'd)

KNIGHT—*(Cont'd)*

Model	kc
6849, 6946	465
6949	465
7139, 7140	465
7371-74	465
7700, 7721	465
7740, 7742	465
9100, 9139	465
9140, 9172	465
9700 Series	see 9700 Series listings prefixed by letter "A", on page 298.
9800 Series	see 9800 Series listings prefixed by letter "A", on page 298.
10,000 Series	see 10,000 Series listings prefixed by letter "A" and letter "B" on page 298.
9801, 9817	465
9834, 9835, 9836	456
9840, 9841, 9842	456

KOLSTER
(Kolster Radio Inc.)

Model	kc
K-JJ	175
K-55	175
K-60, K-62, K-63	175
K-65, K-66	175
K-70	175
K-72, K-73	175
K-75, K-76	175
K-80, K-82, K-83	175
K-85, K-86	175
K-90, K-92	175
K-93	175
K-95, K-96	175
K-100	175
K-102, K-103	175
K-105, K-106	175
K-110, K-112	175
K-113, K-114	175
K-120	175
K-122, K-123	175
K-125	175
K-130	175
K-132, K-133	175
K-135	175
K-140	175
K-140, K-142	175
K-143	175
K-145, K-165, K-195	175

LAFAYETTE
(Wholesale Radio Service Co., Inc.)

Model	kc
Auto Radio	262
D. P. Special No. 371	456
Fireside 1, 2	175
Orthatone (Early)	262
Orthatone (Late)	507.5
P. A. Tuner	456
6 Tube Super	262
A-7	115
A-11, A-12, A-14, A-15	175
A-18	456
A-19	115
A-20 (chassis A-20-C)	175
A-22, A-23	456
A-24	175
A-25, A-26	115
A-31, A-33, A-34	456
A-38 (chassis A-33)	456
A-39	456
A-54	456 or 465
A-60	175
A-70, A-71	456
A-77	175
A-77-L	115
A-81, A-81-L, A-84	456
AM-8	175
AM-10	115
AM-20	175
AM-25	115
AM-26	175
AM-36	115
AM-40, AM-42	456
AM-44	175
AS-6	465
B8	456
B-12	175
B-13, B-14, B-18	456
B-21, B-22 (chassis B-21)	456
B-23 (chassis B-21)	456
B-25	456
B-28, B-29 (chassis B-30)	456
B-30, B-32, B-33	456
B-34, B-35	456
B-36, B-37 (chassis B-35)	456
B-39, B-40	456
B-41 (chassis B-39), B-42	456
B-43, B-44, B-46	456
B49, B50	456
B-51, B-52	175
B-53 (chassis B-51)	175
B-54 (chassis B-51)	175
B-59, B-60, B-62	175
B-64, B-65	175
B-68, B-69	456
B-71	456
B-72	456
B-75, B-76	456
B-77, B-78	456
B-80, B-81	456
B-82 (chassis B-80)	456
B-86	456
B-87, B-88	456
B-89 (chassis B-87)	456
B-90, B-92	175
B-97, B-98 (chassis B-97)	456
BA-1, BA-2, BA-4	456
BA-19	456
BB-9	456
BB-28, BB-30	456
BB-32, BB-35, BB-40	456
BB-48	456
C-1	456
C-10	175
C-12, C-13, C-14	456
C-15, C-16, C-17	456
C-18, C-19	456
C-20	456
C-21	456

(Cont'd)

LAFAYETTE—(Cont'd)

Model	kc
C-22, C-23	175
C-25, C-26	456
C-27, C-30	456
C-31, C-32, C-33	456
C-34, C-36, C-37	456
C-38, C-39	456
C-40, C-41, C-42	456
C-45	456
C-46, C-47, C-48	456
C-50, C-51, C-52, C-53	456
C-57, C-59	456
C-60	175
C-61, C-62	456
C-63	456
C-64, C-65	456
C-68, C-69, C-70	456
C-74, C-75, C-76	456
C-78, C-78-L	456
C-79, C-80	456
C-81, C-82	456
C-83	456
C-84 (chassis C-83)	456
C-85, C-86	456
C-87, C-88	456
C-89, C-90, C-91	456
C-95	456
C-96, C-97 (chassis C-95)	456
C-98, C-99	456
C-305	181.5
D-2, D-3, D-4	455
D-5	455
D-6	456
D-8, D-10	456
D-11	465
D-13, D-14	456
D-15 (6 V. home radio)	456
D-15 (auto radio)	262
D-16	456
D-17, D-18, D-20	456
D-21, D-22, D-23	456
D-27, D-28, D-29	456
D-30 (chassis D-31), D-31	456
D-37 (auto radio)	262
D-39	262
D-41	456
D-45, D-46	175
D-48, D-48-A, D-49	456
D-50, D-51	456
D-52	175
D-53, D-54	456
D-58, D-59, D-60	455
D-61, D-62, D-63, D-64	455
D-79, D-80, D-83	456
D-84, D-87, D-89	456
DA-11	465
DA-15, DA-16	456
DA-20, DA-28, DA-31	456
E-20, E-204	115
EB-8, EB-9, EB-15	456
EB-17, EB-17-A	262
EB-52, EB-56, EB-58	456
EB-65, EB-66, EB-67	456
EB-70	456
EM-16 (auto radio)	456
EM-47	456
F-20	465
F-32	115
F-36, F-44 (chassis F-32)	115
F-49, F-50	456 or 465
F-59, F-60	456 or 465
FA-3, FA-6	456
FS-7, FS-8	456
FS-29, FS-30	456
FS-43, FS-44, FS-47	456
FS-66, FS-67	456
J-3	370
J-4	456
J-16	456

(Cont'd)

LAFAYETTE—(Cont'd)

Model	kc
J-19	456
J-20	456
J-33	465
J-37	480
J-38, J-39	456
J-40, J-41	456
J-43, J-44	456
J-50	465
J-79, J-80	456
JA-1, JA-2, JB-3	456
L-1, L-2	175
L-3, L-4 (chassis L-1)	175
L-11, L-12 (chassis L-11)	175
L-16, L-17, L-18 (chassis L-11)	175
L-19 (chassis L-11)	175
L-20 (chassis 05-A)	262
L-22, L-23	262
L-30 (Early) (chassis 6V)	262.5
LW-10	175
M-9, M-9-LW	465
M-11	456
M-31 (1932 set)	175
M-31 (1937 set)	465
M-31-71	175
M-35, M-37 (chassis M-35)	175
M-41, M-43	520
M-44	456
M-47	520
M-53, M-65	175
M-69	115
M-91	456
M-94 (auto radio)	262
MB-3, MB-4 (chassis MB-3)	456
MB-5, MB-6 (chassis MB-5)	456
O5A-L20	262
S-9 (auto radio), S-61, S-62	456
SB-7, SB-8	456
S61, S62	456
SL45	175
U-145, U-155	507
2A5	175
6-U	262.5
10, 10C10 (Series 20)	175
40-A	175
80-M (chassis 40A)	175
137X, 143, 144	456
149, 150X	456
151, 154	465
171X	456
186, 188	465
324	456
371	456
480	456
2001	175

LANG
(Lang Radio Co.)

Model	kc
MA-7, MA-8	175
MD-7, MD-8	175
SA-7, SA-8, SA-9	175
SC-7, SD-7, SD-8	175
UG-5B	456
40-UL	470

(Cont'd over)

LANG—*(Cont'd)*

Model	kc
41-UP	470
50-AS	470
50-UP	470
50-US	456
51-AS	470
52-PC	456
60-AA, 60-PC, 60-UP	470
66-AA	470
70-AA, 70-UA	470
80-AC	175
80-NA, 80-UA	470
81-UA, 81-VA	470
502-US, 502-VA	456
503-AS	175
503-US, 503-UT	470
523-UT	470
703-US	175

LARKIN CO., INC.

Model	kc
88, 90, 91, 92	175

LA SALLE
(also see listings under Champion Radio Labs.)

Model	kc
558	456

LAUREHK RADIO MFG. CO.
(Car'uso, Laurehk, Laurette, Musique)

Model	kc
A-37	175
AE-5	456
AE-5-B	465
AE-6	175
AE-42 (auto radio)	175
AE-55	456
AE-79 (auto radio)	175
AM-6	175
L-5-C, L-5-S	456
L-6A, L-7, L-7A	456
L-8-AW	456
L-19, L-19-P	456
L-26	175
L-40, L-66	456
L-67, L-77	456
L-409, L-500	456
L-508, L-512	456
6-6A	456
11-ESQ	175
66	175
L-600	175

LAURETTE
(See Laurehk Radio Mfg. Co.)

R. E. LECAULT

Model	kc
LR4	175
L2 Ultradyne	175

LEHMAN RADIO SALON, INC.
(See Port-O-Matic)

LEUTZ

Model	kc
C-10	450

LEWOL
(Lewol Mfg. Co.)

Model	kc
Deluxe 6	177.5
12A	456
60MS	456
63, 64	262.5
101B	456
102B	177.5

LINCOLN RADIO CORP.

Model	kc
*AC8	480
R-9	480
*SW8 (DC)	480
SW-10 (DC)	480
*SW-32	480
SW-33	480
*8-80	480
*31	480
*34	480

* Definite information on these models is not available. It is likely that their i-f is 480 kc.

LINCOLN—LINCOLN-ZEPHYR
(Ford Motor Co.)
(Also see Lincoln-Zephyr Models listed under Philco)

Model	kc
L-1424 (Philco auto radio)	260
L-1427, L-1560	260
LT14X3	260

L'TATRO
(L'Tatro Mfg. Co.)

Model	kc
A-525	456
AK-54, AM-54	177.5
AQ-69	456
A525	456
B-525	456
BM-64	457
BQ-69	456
C-625	177.5
CM-65	457
CQ-69	456
D-625	177.5
DM-65	457
DQ-39	456
DQ-69	456
EN-6-4	457
EQ-39	456
F-725	177.5
FN-66	457
FQ-39	456
GN-66	457
GQ-39	456
GQ-89, H-465, HQ-39	456
HQ-39	456
I-465	456
II-465	456
IN-2-5	457
J-665	177.5
JN-27	457
JQ-19	456
K-665	177.5

(Cont'd)

L'TATRO—*(Cont'd)*

Model	kc
KN-27	457
L-54	177
L-74	175
L-525	456
LO-26	170
LQ-39	175
M-4616	456
MO-26	170
N-54	177
N-74	175
OO-65	175
NO-65	175
NQ-69	175
O-84	177
O-94	175
O-4626	456
OQ-29	456
P-54	177.5
P-4626	456
Q-5636, QP-65	456
R-5636, RP-66	456
S-5636	456
SP-67, SP-68	456
T-6216	177.5
TP-67	456
U-5226, UP-36	456
V-5226, VP-38	456
W-6236, X-6236, Y-6236	456
ZP-36	456
219	175
419	456
519, 619	456

LYRIC
(See Wurlitzer & Co.)

R. H. MACY & CO.

Model	kc
410 AC-DC	456
706-70623	456
MB-710	175

THE MAGNAVOX CO., INC.

Model	kc
CR101, 101M	465
CR102, CR103	456
CR104, CR105	456
CR106, CR107	455
CR108M	455
CR109, CR110	455
CR111, CR112	455
CR113, CR114	455
CR115, CR117	455
CR118, CR119	455
CR120, CR121	455
CR125, CR126	455
CR127, CR128	455
CR133, CR134	455
CR136, CR137	455
CR140 to CR145 incl.	455
CR146, CR147	455
CR148, CR150	455
CR151, CR153	455

MAJESTIC
(Majestic Radio & Television Corp.)
(Successors to Grigsby-Grunow Co. Also see listings under Case)

Model	kc
Charlie McCarthy 1, 2	455
1A50 Ser.	455
P1A40 Ser.	455
1A59	455
1A59B	455
P1A59	455
1B59	455
P1B59	455
1D50MB	455
1D59EB-PL	455
1M40 Series	455
2H50 Series	455
3C70, 3C80	455
3C80P	455
3SC80	455
3SC80B	455
3C90, 3SC90	455
5BDA, 5BEA	455
6UL51	455
7-B (chassis)	262
9-A	262
10, 11	1,000
11-A	262
15, 15-B	175
20, 21, 22, 23, 25, 25-B	175
35	175
44, 49 (440 chassis)	456
50, F-50	175
51, 52	175
55 (AC-DC), 56, 57	455
58	175
59	456
60	456
61 (AC-DC)	455
61EB	455
62	175
62A	455
65, 66	456
67, 68, 69	455
75, 76	456
77	175
85, 86 (800 chassis)	456
94	456
95, 105	175
111, 111-40	175
114	175
116, 116-A	175
118, 118-P	175
120, 120-B	175
121, 123	175
149I, 149N, 149W	455
150, 151, 153	175
154, 155	175
156	455
160, 163	175
194, 195	456
194, 195 (440 chassis)	456
196	175
200, 201, 203, 204	175
210, 211, 214, 215	175
220, 221, 223	175
251, 251-B	175
253, 253-B	175
254, 254-B	175
260A, 260B	175
290, 291, 293, 294	175
300, 300-A	175
303, 304, 307	175
310-A, 310-B	175
320, 324	175
330, 331	175
336, 337	175
340, 340-B	175

(Cont'd)

MAJESTIC—(Cont'd)

Model	kc
344	175
351, 353	175
360, 363	175
370, 371, 373	456
390	175
400, 400-A	456
411, 411-A, 413, 413-A	456
419	455
440	456
450	455
460, 461, 463	175
490, 491, 493	175
500	456
511, 511A, 519P	455
520	175
550	455
551	455
560	455
566	456
570	175
600 (AC-DC)	456
620	456
639	455
650	456
651	262
651EB	455
660, 661, 662	262
666	175
670, 671	455
673, 674, 675, 690	455
699	455
739	455
750	456
775	455
776	175
800, 850	456
870 (chassis 1870), 875	455
886	175
939	455
996, 998	175
1050	456
1056, 1056X, 1058, 1058X	455
1101	262
1151, 1152	262
1250	456
1356, 1356X	455
1656, 1656X	455
1870	455
11056, 11058	455
11356	455

MARCONIPHONE INC.

Model	kc
Vanity ('37), ('38)	456
D, DE (1937)	175
D8 (1938)	175
D10 (1938)	175

MASTERPIECE
(See McMurdo Silver)

MEISSNER MFG. CO.

Model	kc
Ace Star Junior	370
Ace Star Senior	370
De Jong 8	456
9-1047 (tuner)	4300
9-1054	4300
10-1100, 10-1101 "Custom"	456
10-1103, 10-1104 "Utility"	456

(Cont'd)

MEISSNER MFG. CO.—(Cont'd)

Model	kc
10-1107, 10-1108 "Batt."	456
10-1109 "Batt."	456
10-1110, 10-1111 "Utility"	456
10-1112 "Batt."	456
10-1113 "Traffic Scout"	456
10-1114 "Custom"	456
10-1115 "Traffic Master"	456
10-1116 "Combination"	456
10-1117 "Custom"	456
10-1128 "Custom"	456
10-1129 "Custom"	456
10-1155 "Custom"	456
10-1156 "Custom"	456
10-1164 "Combination"	456
10-1165 "Custom"	456
10-1166 "Custom"	456
10-1167 "Custom"	456
10-1168 "Custom"	456
10-1169 "Traffic Scout"	456
10-1170 "Traffic Scout"	456
10-1173 "Traffic Master"	456
10-1174 "Traffic Master"	456
10-1187 "Portable 5"	456
10-1188 "Portable 5"	456
7501, 7501A "Custom"	456
7502, 7502A "Communications"	456
7506, 7507 "De Luxe"	456
7508A (All Wave 8)	456
7508B (All Wave 8)	456
7509 "De Luxe"	456
7535, 7536	456

MELL-O-TONE
(Mell-O-Tone Radio Corp.)

Model	kc
Vagabond	465

MELBURN
(Melburn Radio Mfg. Co.)

Model	kc
23	465
31	465
40	465
45	465
50	465
55	465

THE MERSMAN BROS. CORP.
(See Brunswick)

MIDWEST
(Midwest Radio Corp.)
(Midwest, Miraco)

Model	kc
Imperial	456
Regal	456
Royale	456
A-16, AA-14	456
AA-16, AA-18	456
B-16, BB-14	456
BB-16, BB-18	456
C-12, C-16 (1933 Model)	450
C-16, CC-14	456
CC-16, CC-18	456
CT-12, CT-16	450
D-7, D-16	456

(Cont'd over)

MIDWEST—(Cont'd)

Model	kc
DD-14, DD-16, DD-18	456
E-7, EE-18	456
F-9, F-10, FF-18	456
G-9, G-10	456
G-11, GG-11	456
H-6, HH-7	456
J-11, JT-11	456
K-11	456
K-12, K-16	450
KP-16	456
L-11	456
L-12, L-16	450
M-10, M-11	456
M-12	450
M-14, M-16 (Later Model)	456
M-16 (Earlier Model)	450
MT-14	456
P-14	456
PR-16	450
Q-14	456
R-9, R-10, R-11	456
R-14, R-16, RT-9	456
RT-11, RT-14, RT-16	456
S-16, SW5-36	456
T-16, U-16	456
V-18, VT-18	456
W-18, X-18	456
Y-18, Z-18	456
5-35 (AC-DC)	465
5-36 (AC-DC; SW)	456
5-36 (Auto)	456
6-33, 6-34	450
6-37 (AC-DC)	456
6-37 (auto radio)	175
6-38 (AC-DC)	456
7-36	456
7-36 (AC-DC)	450
7-36 (Battery)	465
7-37, 7-37 (AC-DC)	456
7-37 (Battery)	465
7-38	456
8-33, 9-34	450
9-38	456
10-34, 10-35, 10-37 (AC-DC)	456
10-37, 10-38, 11-31	456
11-32	175
11-36, 11-37, 11-37 (AC-DC)	456
12-33	450
12-38AC	456
12-38 (Battery)	456
12-39	456
14-37, 14-37A	456
14-37 Int., 14-Z-9	456
16-33, 16-34	450
16-35, 16-37	456
16-38	456
18-35, 18-36, 18-36A, 18-37	456
18-38	456
18-38 AC	456
20-38	456
22-37, 24-36	456
35-5SW	465
39-8 Batt.	456
39-8 AC	456
39-8 AC-DC	456
39-12	456
39-17	456

JAMES MILLEN
(See National)

MIRACO
(See Midwest)

MISSION BELL
(Mission Bell Radio Mfg. Co.)
(Aeronautic, Hobbs, Mission Bell)

Model	kc
10, 10-A	252
11 (auto radio), 12	252
14 (auto radio)	456
16	465
16 (Auto)	456
19, 19-A	252
19-B	252
25-A	252
40	456
40AW	456
41	465
41 (Skip Band), 41AW	465
42	252
43, 43AW, 44	465
374, 375, 378	456
383	465
384	465
385	262.5
386, 386AW	465
386C, 387, 387B	465
388, 389, 390, 391	465
392, 393, 395	465
400, 401, 402	465
500, 501	465
638, 638A (auto radios)	267.5
738, 738A (auto radios)	267.5
3516 (auto radio), 3517	465
3518	262
3519	252
3545, 3546	465
3616, 3617, 3618 (auto radios)	465
3710	456
3716	267.5
3717, 3718 (auto radios)	267.5
3718 (DeLuxe)	262
3810, 3810C	465
3811	262.5
3817 (auto radio)	267.5
3818 (auto radio)	262.5
3820 (auto radio DeLuxe)	262.5
3749	465
3817A	267.5
3849, 3859	465
3869, 3871	465
3891	465

MONARCH
(See Champion Radio Labs.)

MONTGOMERY WARD & CO.
(See listings under Airline)

MOTO-METER GAUGE & EQUIPMENT CO.
(Moto-Vox)

Model	kc
Moto-Vox 10-A (above 500)	175
Moto-Vox 10-E	175

MOTOROLA
(Galvin Mfg. Corp., Goldenvoice)

Model	kc
Dual 6, Dual 34	262
FSR-13 1st I-F	4300
FSR-13 2nd I-F	455
FMR-13 1st I-F	4300
FMR-13 2nd I-F	455
Goldenvoice (1936, 1937 and 1938 auto radio)	262
Super 6	456
Twin 8	262
A-1	455
A-1 Series B	455
B-150	455
D-6	262
J-8	175
P-69-12 (Police)	262
P-69-13 (Police)	262
P-69-14 (Police)	262
P-69-17	3000
P-69-18	262
T-8	262
T-77	456
S-10	175
3-A-5	455
5T, 5T1, 5T2, 5Y	465
6	456
6A, 6A2, 6T, 6X, 6Y	465
7-T-47-A	175
8-30, 8-40, 8-50 (auto radios)	262
8-60, 8-70 (auto radios)	262
8-80 (auto radio)	262
9-A, 9-R, 9-Y	465
9-24, 9-24A	455
9-29, 9-39	262
9-44, 9-49, 9-69	262
10-Y, 10-Y1	465
12-Y, 12-Y1	465
15-F (Ford)	455
16-C (Chevrolet)	455
17-D (Chrysler)	455
17-DA	455
18-O (Oldsmobile)	455
19-B (Buick)	455
20-P (Pontiac)	455
21-L (Cadillac, LaSalle)	455
22-S (Studebaker)	455
24-K (Packard)	455
25-F (Ford-Mercury)	455
25-N (Nash-Lafayette)	455
26-C (Chevrolet)	455
26-C-7 (Chevrolet)	455
27-D (Chrsyler, DeSoto, Dodge, Plymouth)	455
27-D-6 (Chrysler, DeSoto, Dodge, Plymouth)	455
28-O (Oldsmobile)	455
29-B (Buick)	455
29-B-6	455
30-P (Pontiac)	455
34	262
34K-6 (Packard)	455
34K-7 (Packard)	455
35F	262
35N (Nash)	455
37D-1	262
37D-2	455

(Cont'd.

MOTOROLA—(Cont'd)

Model	kc
38-O	262
40-B1	455
40-BK	455
40-BW	455
40-P	262
40-40B *	455
40-50W	455
40-60W	455
41A, 41B, 41D1	455
41D2, 41E, 41F	455
41S	455
42-S, 43-H	262
44	456
44-K	262
45	262
45-B-11, 45-B-12	455
45-N	262
50	262
50X-1	455
50X-2	455
50XC-1	455
50XC-2	455
50XC-3	455
50XC-4	455
50XH-1	455
50XH-2	455
50XW	455
51A, 51C	455
51D1, 51D2	455
51F11, 51R11	455
51X11, 51X12, 51X13	455
51X14, 51X15, 51X16	455
52C	455
52T	465
52T1	455
52XAH1	455
52Y	465
53A, 53C	455
54A	455
55	456
56T	465
56X-1, 56XA-1	455
56XAW	455
56Y	465
57	456
57BP1	455
57BP2	455
58-F1	455
58-FRC	455
59F1, 59K1	455
59T1, 59T2, 59T3	455
59T4, 59T5	455
60	262
60X-1, 60X-2	455
60XA-1, 60XA-2	455
60XW	455
60XW3	455
61	175
61-13	455
61A, 61B, 61C	455
61CA, 61D, 61DA	455
61E, 61F21	455
61K21, 61K22	455
61T23	455
61X11, 61X12, 61X14	455
61XW	455
62	262
62A	455
62B, 62E	455
62F1, 62T1	455
62L11, 62L12	455
62T2	455
63A, 63E	455
65BP1, 65BP2	455
65BP3, 65BP4	455
66	456
69K1	455
70 (auto radio)	262
75	262

(Cont'd)

MOTOROLA—(Cont'd)

Model	kc
77	456
*77-A, *77-B	456
79, 80	262
80C, 82A, 83F1	455
81F21, 81K31	455
83K1	455
88	175
89K1, 89K2, 89K3	455
93F1	455
100	262
101C31	455
103CK, 103F1	455
103F2, 103K1	455
103K2	455
109K1, 109K2	455
110	262
250, 251	455
300, 301, 350, 351	262
400, 401, 450, 451	262
500, 501, 550, 551	262
700, 701	262

* See also the corresponding listing under the letter "T" model such as T-77, etc.

MOTO-VOX

(See Moto-Meter Gauge & Equipment Co.)

MUSIQUE

(See Laurehk Radio Mfg. Co.)

NASH
(Nash Motors Co.)

(Also see Nash Models listed under Philco Radio & Television Corp.)

Model	kc
AC989, AC1089, AC1289	260
C, D	260
N-1418, N-1434	260
N-1514, N-1524	260
NDD, NJD	260
NN-1433, NQD	260
NT-8, NT-12X	260
NT-15	260
Q	260
T7, T-8	260

NATIONAL
(The National Co.—James Millen)

Model	kc
National "HRO" Junior	456
National "HRO" Standard	456
AGS, AGSX	495
FB-7A, FBXA	495
NC-44	456
NC-80X, NC-81X	1560
NC-100	456
NC-100A	456
NC-100X	456
NC-100XA	456
NC-101X	456

NOBLITT-SPARKS INDUSTRIES, INC.
(See Arvin)

NORCO
(Also see Remler)

Model	kc
21	250
160	450
178, 179, 180	450

OLDSMOBILE
(Oldsmobile Auto Co.)
(See United Motors Service)

ORPHEON
(See McMurdo Silver, Inc.)

OZARKA
(Ozarka Inc.)

Model	kc
93, 93-A, 93-B, 94-AVC	175

PACIFIC CRUSADER
(See Pacific Radio Corp. of Los Angeles, Cal.)

PACIFIC RADIO CORP.
(of Los Angeles, Cal.)

(Jackson Bell, Pacific Crusader. For early Jackson Bell receivers, see listing under Jackson Bell Co., Ltd.)

Model	kc
28	456
34, 34S, 37	456
37A, 37AT, 37P, 37T	456
45	456
50, 55, 55-CM	456
57, 57A, 57AN, 57C	456
57P, 57T, 57X	456
60, 80	456
406, 456	456
506, 506M, 556	456
577	456
577A	456
606, 606M, 606U, 606UM	456
806, 806C, 806X	456

PACIFIC RADIO CORP.
(of Chicago, Illinois)
(Pacific)

Model	kc
Midget Super	456
A60B	465
H5	456
H6, H7	262
M7	456
Z2	456
3	465
5, 5SW, 6V	456
8T-6V	465
11	456
12, 14	465
21, 22	456
23, 24	465
25, 30, 31	456
35, 35-38	465
36, 36-38	465
38H5 (auto radio)	456
38H6 (auto radio)	262

(Cont'd over)

PACIFIC RADIO CORP. —(Cont'd)

Model	kc
40, 40-38	465
41, 41-38	465
42, 43	465
50, 51	465
61	456
80, 81A, 90	465
101	456
102	177.5
102 (Early)	175
102B	262.5
110, 150	465
301, 302	465
320	465
321-36	465
321-37	465
481	456
601	465
681, 682	465
702	465
915	465
3280	465
6320, 6322	465
6322XE	465
6370, 7370	465
14370	465

PACIFIC RADIO EXCHANGE

Model	kc
Spero Super	175

PACKARD-BELL (Packard-Bell Radio Co.)

Model	kc
5 (auto radio)	460
5 (home radio)	460
5A, 5B	460
5M, 5T	460
5TP	460
7, 15, 25	460
35, 35 Jr., 35A, 35G	460
35H, 35J, 35L, 35LP	460
35M	460
36, 45	460
45AVC	460
46, 46A	460
46B, 46BK, 46C, 46D	460
46DP, 46E	460
46PC, 46PM	460
47	458
48, 48A	460
48AK, 48B, 48BC	460
48BK, 48BP	460
48D	460
50, 50A, 55	460
65 (auto radio)	460
65 (home radio)	460
66, 66A, 67 (auto radio)	460
75 (auto radio)	460
76 (auto radio)	460
76 (home radio), 77	465
78 (auto radio)	460
86	465
120	460
120A, 120AB, 120C	460
160	460

PACKARD (Packard Motor Car Co.)

(Also see Packard models listed under Philco Radio & Television Corp.)

Model	kc
P1417, P1421	260
P1430, P1432	260
P1438, P1439	260
P1517, P1530, P1535	260
PA, PB	260
PHD, PHXD, PT14	260

PACKARD RADIO CORP.

Model	kc
4-Tube Super 5	465
6-Tube Auto Radio	470
4	235
5	470
11, 13	235
24, 24-C	235
46, 85	470

PARAMOUNT RADIO CO.

Model	kc
6C-607, 6L-137	456
6M-27, 6U-107	456
7C-707, 7L-147	456
7U-117	456
8C-807	456
8U-127	456
10C-1007	456

PATHE

Model	kc
P5	455
38T, 40T	455
52, 54	455
114C	455
500P	455

PATTERSON (Patterson Radio Co.)

Model	kc
PR-10	432.5
PR-15	465
PR-16, PR-16-C, PR-16-CK, PR-16-CKP	458
PR-16-CTS, PR-16-CTS-C	458
PR-16-K, PR-16-KP	458
R-16	458
2-128	465

(Cont'd)

PATTERSON—(Cont'd)

Model	kc
2-129	465
2-169	465
60 series	465
65-AW, 65-SW	262.5
70-AW	262.5
74-AW, 75-AW	458
75-AWA	458
77B, 77BA	465
80-AW	262.5
84-AW, 85-AW	458
85-AWA	458
86-AW	458
87, 87A	465
88, 89, 90	465
104-AW, 105-AW	432
106-AW	458
107, 107A	465
107-AW	262.5
108, 109	465
110, 111	465
126AW	458
127, 127A	465
128, 129, 130	465
168	465
175-AW, 175-AWA	458
185-AW, 185-AWA	458
186-AW	458
198	465
207-AW	262.5
208	465
210-AW	262.5
212	465
268	465
275-AW, 275-AWA	458
285-AW, 285-AWA	458
286-AW	458
298	465
308, 312	465
375-AW, 375-AWA	458
385-AW, 385-AWA	458
386-AW	458
408, 412	465
507-AW	262
508-AW, 510-AW	262.5
1105-AW	435
1106-AW	458
1126-AW	458
2105-AW	435
2106-AW (10 tubes)	458
2106-AW (12 tubes)	458
2126-AW	458
3105-AW	435
3106-AW	458
3126-AW	458
4105-W	435

PETER PAN (Peter Pan Radio Mfg. Co.)

Model	kc
4-S	465
6	260
25-AV, 25-UV	255
45-37	465
56	465
58 (auto radio)	465
77	465
77-A	465
88	465
555	465

PHILCO

(Philco Radio & Television Corp.)

(Auburn, Chrysler, Ford, Graham-Paige, Lincoln-Zephyr, Nash, Packard, Philco, Pierce-Arrow, Reo-Mack, Studebaker, Transitone, Willys. Also see Radiobar Co. of America)

Model	kc
A (auto radio)	260
AC-206 (Studebaker)	260
AC-236 (Studebaker)	260
AC-266 (Studebaker)	260
AC-989 (Nash C, D)	260
AC-1089 (Nash Q)	260
AC-1189, AC-1289	260
AR-1, AR-4, AR-5	455
AR-6, AR-7, AR-8	455
AR-9	455
B (auto radio)	260
B6 (Code 122) (auto radio)	260
C (121, 122), C-1423 (auto radios)	260
C-1450, C-1452 (auto (radios)	260
C-1550	260
C-1606 (Chrysler)	400
C-1608 (Chrysler)	470
C-1708 (Chrysler)	455
CT-2, CT-5, (Chrysler)	260
CT-10, CT-11 (Chrysler)	260
D (121-122) (auto radio)	260
DP, DPV (police auto radios)	260
E (Pierce-Arrow) (auto radio)	260
F-1440, F-1442 (Ford)	260
F-1540 (Ford)	260
F-1640 (Ford)	470
F-1641	470
F-1740 (Ford)	455
FN	260
FT-6, FT-9	260
G (121, 122) (auto radio)	260
G-1418, G-1436 (auto radio)	260
G-1528 (Graham)	260
G-1628	470
H (121, 122) (Packard) (auto radio)	260
HG (Hupmobile)	260
HT-11X	260
J (auto radio)	260
L-1420 (auto radio)	260
L-1424 (Lincoln-Zephyr) (auto radio)	260
L-1425, L-1427 (auto radios)	260
L-1429, L-1460 (auto radios)	260
L-1460 (Lincoln)	260
L-1560 (Lincoln)	260
L-1660 (Lincoln)	470
L-1760	455
L-1761	455
LT-14X3 (Lincoln)	260
ME (Pierce-Arrow)	260
MT3 (Pierce-Arrow)	260
MT14X4	260
N, N-1418 (auto radios)	260
N-1433, N-1433H (auto radio)	260
N-1434, N-1434H (auto radio)	260
N-1514 (Nash)	260
N-1524 (Nash)	260
N-FND (Ford)	260
NT-12X, NT-12x2 (Nash)	260

(Cont'd)

PHILCO—(Cont'd)

Model	kc
NT-15, NT-15X (Nash)	260
P-1417, P-1421 (Packard) (auto-radios)	260
P-1422 (auto radio)	260
P-1426, P-1430 (Packard) (auto radios)	260
P-1432 (Packard) (auto radio)	260
P-1432H (auto radio)	260
P-1438, P-1439 (Packard) (auto radios)	260
P-1517 (Packard)	260
P-1530 (Packard)	260
P-1535 (Packard)	260
P-1617 (Packard)	470
P-1630, P-1635 (Packard)	470
PA, PB (Packard)	260
PHD, PHXD	260
PT-2	455
PT-5 (Packard)	260
PT-6, PT-12	455
PT-14	260
PT-25	470
PT-26	455
PT-27	470
PT-28	455
PT-29	470
PT-31	470
PT-33	455
PT-35	470
PT-36	455
PT-37, PT-38	470
PT-41, PT-43	455
PT-45	470
PT-46	455
PT-47	470
PT-48	455
PT-49	470
PT-50	455
PT-51, PT-53	470
PT-55, PT-57	455
PT-59	470
PT-63, PT-65	455
PT-66, PT-67	455
PT-69	455
PT-91, PT-92	455
PT-93, PT-94	455
PT-95	455
Q (auto radio)	260
R (auto radio)	260
RT-3 (Reo)	260
R-1415 (auto radio)	260
S-1416 (Studebaker) (auto radio)	260
S-1431 (Studebaker) (auto radio)	260
S-1437 (Studebaker) (auto radio)	260
S-1516 (Studebaker)	260
S-1526 (Studebaker)	260
S-1616 (Studebaker)	470
S-1622 (Studebaker)	470
S-1626	470
S-1722 (Studebaker)	470
S-1726	455
ST-12 (Studebaker)	260
ST-15 (Studebaker)	260
T2, T3, T5 (auto radios)	260
T6, T7, T8 (auto radios)	260
T9, T10 (auto radios)	260
T11, T11X (auto radios)	260
T12, T12X, T12X2 (auto radios)	260
T14, T14X, T14X3 (auto radios)	260
T14X4, T15 (auto radios)	260
TH-3	470
TH-4, TH-4T, TH-5	470
TH-5T	470

(Cont'd)

PHILCO—(Cont'd)

Model	kc
TH-9, TH-14, TH-15	455
TH-16, TH-17, TH-18	455
TH-22	455
TP-4, TP-4I, TP-5	470
TP-10, TP-11, TP-12	470
TP-20, TP-21	455
W-1419 (auto radio)	260
4	1,000
5	460
*6, 6F (122) (auto radios)	260
7, 8 (121) (auto radios)	175
*9 (122) (auto radio)	260
10 (121, 122) (auto radio)	260
11 (121, 122) (auto radio)	260
12 (Code 121) (auto radio)	175
12 (Code 122) (auto radio)	260
12-TP	470
14 (Codes 121, 122, 123)	175
14 (Codes 221, 222)	175
15, 15-DX, 15-X	175
16 (Codes 121, 122, 123)	460
16 (Codes 125, 126, 127)	460
16-B, 16-L, 16-X	460
17 (Codes 121, 122, 123)	175
17 (1938 model)	470
17-22	175
18 (Codes 121-124)	260
18-B, 18-H, 18-MX	260
19	260
22, 22-L, 23, 23-X	260
24	175
25	460
26	260
27	260
28	460
29, 29-TX, 29-X	460
32, 32-B, 32-L	260
34, 34-A, 34-B, 34-L	460
35, 35-B, 36	260
37	175
37-10, 37-11	470
37-33, 37-34, 37-38	470
37-60	470
37-60B, 37-60F	470
37-61	470
37-61B, 37-61F	470
37-62	470
37-84 (Code 122)	470
37-89	470
37-93	470
37-116 (Codes 121, 122)	470
37-600	470
37-602	470
37-604	470
37-610 (Codes 121-122)	470
37-611	470
37-620	470
37-623, 37-624	470
37-630	470
37-640	470
37-641	470
37-643	470
37-650	470
37-660	470
37-665	470
37-670	470
37-675 (Codes 121, 122)	470
37-690	470
37-2620	470
37-2650	470
37-2670	470
38 (Codes 121, 122, 123)	460
38A (Codes 121, 122, 123)	460
38-B, 38-L	460
38-1, 38-2, 38-3 (Code 121)	470
38-4, 38-5 (Code 121), 38-7	470
38-8, 38-9, 38-10 (Code 121)	470

(Cont'd over)

PHILCO—*(Cont'd)*

Model	kc
38-12 (Code 121), 38-14, 38-15	470
38-22, 38-23, 38-33	470
38-34, 38-35, 38-38	470
38-39, 38-40	470
38-60, 38-62	470
38-89 (Code 125), 38-93, 38-116	470
38-116 (Code 121)	470
38-116 (Code 125)	470
38-610, 38-620	470
38-623, 38-624, 38-630	470
38-643, 38-665, 38-690	470
38-2620, 38-2630	470
38-2650, 38-2670	470
39, 39-A	460
39-3-31PA	470
39-6	470
39-7	470
39-8	470
39-12, 39-12CB, 39-12T	470
39-14, 39-14CB	470
39-15, 39-15CB	470
39-17, 39-17F, 39-17T	470
39-18, 39-18F, 39-18T	470
39-19, 39-19F	470
39-19PA, 39-19 PCS	470
39-19 PF, 39-19 PT	470
39-19T	470
39-25 (Code 121)	470
39-25T, 39-25XF	470
39-30 (Code 121)	470
39-30 PCX	470
39-30T, 39-30X	470
39-31 (Code 121)	470
39-35 (Code 121)	470
39-35XX	470
39-36	470
39-36XX	470
39-40, 39-40 PC	470
39-40 PCX	470
39-45 (Code 121), 39-45XX	470
39-55, 39-55RX	470
39-70 (Codes 121 & 122)	470
39-70B, 39-70F	470
39-72T	470
39-75F	470
39-75T	470
39-80 (Codes 121 & 122)	470
39-80B, 39-80XF	470
39-85B, 39-85XF	470
39-116	470
39-116PX	470
39-116PCX	470
39-118 (Codes 121 & 122)	470
39-720T	470
39-744 (Code 121)	470
39-744T, XX	470
39-750T, XX	470
39-770 (Code 121)	470
39-2770 (Code 121)	470
40-74, 40-81	455
40-81T, 40-82	455
40-83, 40-84	455
40-88, 40-88T	455
40-88TL, 40-90	455
40-95, 40-100	455
40-105, 40-110	455
40-124, 40-125	455
40-130, 40-135	455
40-140, 40-145	455
40-150, 40-155	455
40-158, 40-160	455
40-165, 40-180	455
40-185, 40-190	455
40-195, 40-200	455
40-201	455
40-205	470
40-215, 40-216	470

(Cont'd)

PHILCO—*(Cont'd)*

Model	kc
40-217	470
40-501, 40-502	455
40-503	455
40-504	470
40-506, 40-507	455
40-508	455
40-510	470
40-515	455
40-516	470
40-525, 40-526	455
40-527, 40-710	455
40-715, 40-725	455
40-748, 40-755	455
40-756	470
40-780, 40-2710	455
40-2725, 40-2780	455
41-220, 41-225	455
41-230, 42-235	455
41-240, 41-245	455
41-250, 41-255	455
41-280, 41-285	455
41-287, 41-290	455
41-623, 41-625	455
41-625, 41-629	455
42-323, 42-327	455
42-340	455
42-345	455
42-350 (Code 121) (Amp. Mod.)	455
(Freq. Mod.)	4300
42-355 (Code 121) (Amp. Mod.)	455
(Freq. Mod.)	4300
42-360	455
42-365	455
42-380 (Code 121)	455
42-390 (Code 121) (Amp. Mod.)	455
(Freq. Mod.)	4300
43, 44	460
45, 45-C, 45-L	460
47 (121-122)	260
47-DC (121-221)	260
48	175
49 (DC)	260
49-B, 49-D, 49-H	260
49-X	260
51, 51-A, 52	175
53	460
54, 54-C, 54-S	460
57	460
58	460
59, 59-C, 59-S	460
60, 60-B, 60-L	460
66, 66-B	460
70 (above Ser. No. B 22,000)	260
70, 70A (below Ser. B 22,000)	260
71, 71-221	260
80, 81, 84, 84B	460
89, 89B, 89L	260
90 (with 1-47)	175
90 (with 2-45)	175
90 (with 2-47)	260
90 (above Serial No. 237,001)	175
91 (121-221)	260
91	260
90-A (with 2-47)	260
97-98	460
101, 105, 107	470
108	470
111, 111-A	175
112, 112-A	175
116 (121, 122)	460
116-A	460
116-X	460
116-X (Code 122)	460

(Cont'd)

PHILCO—*(Cont'd)*

Model	kc
118 (121, 123)	260
118-B, 118-D, 118-H	260
118-MX, 118-RX	260
118-X	260
121, 125	470
144, 144-B, 144-H, 144-X	460
200, 200-X	175
201	260
211, 211-A	175
212, 212-A	175
245	460
270, 270-A	260
310	470
370	260
376	470
470, 470-A (S. W. Conv.)	1000
470, 470-A (Broadcast IF)	260
490, 490-A (S. W. Conv.)	1000
490, 490A (Broadcast IF)	175
500, 501	460
503 (Code 122)	260
504, 505	460
506	460
507	260
509	260
551	175
570	260
600	460
602, 604	460
610, 610-PF, 611	460
620, 623, 623A	460
624, 625	460
630, 630-PF, 635	460
640, 641, 642	460
643, 643A, 645	460
650, 651, 655	460
660, 665	460
680	460
700, 800 (122) (auto radios)	260
802, 805, 806 (auto radios)	260
808, 809 (auto radios)	260
†810PA, 810PB (police auto radios)	
810PV (police auto radio)	260
†811PA, 811PB (police auto radios)	
811PV (police auto radio)	260
816, 817 (auto radios)	260
818, 818K (auto radios)	260
819, 819H (auto radios)	260
821PV (police auto radio)	260
826, 827, 827K (auto radios)	260
828, 828K (auto radios)	260
920, 921, 922	260
926, 927, 928K	260
931, 932	455
933, 936, 937	470
938-K	470
1514, 1516, 1517	260
1524, 1526, 1528	260
1530, 1535, 1540	260
1550	260
1560, 1606	400
1608, 1616, 1617	470
1626, 1628, 1630	470
1635, 1640, 1660	470
1418 (auto radio)	260
2620	260

* See also the corresponding listings under letter "FT" models, such as FT-6, FT-9, etc.

† Intermediate frequency = receiver crystal frequency minus transmitter frequency.

PIERCE AIRO, INC.
(See De Wald)

PIERCE-ARROW MOTOR CORP.
(Also see Pierce-Arrow Models listed under Philco Radio & Television Corp.)

Model	kc
E	260
ME	260
MT3	260
MT14X4	260

PIERSON-De LANE
(Pierson-De Lane, Inc.)

Model	kc
PD-88	465
PR-15-C, PR-15-M	465
PR-15-R, PR-15-UH	465
PR-15-X	465

PILGRIM
(Pilgrim Electric Corp.)

Model	kc
AA	456
D, DA	456
DAE, DB	456
DE, DF	456
G, GB, GBE	456
GF, GFE	456
GH, GHE	456
NT, NTE	456
NTH, NTHE	456
Q	175
RJ, RJE	456
RJH, RJHE	456
313	456
623, 624	465
643, 644	465
713, 714	465
753, 754	465
860	460

PILOT
(Pilot Radio Corp.)

Model	kc
Conqueror Chassis	
(Amp. Mod.)	455
(Freq. Mod.)	4300
Dragon 10, 11	115
SW Converter	550
A-6	456
B-2	456
BG-562, BG-563, BX-203	456
C-63, C-114	456
C-153, C-154	175
C-162, C-165	175
C-183, C-193	456
C-203	456
C-213, C-215	456
C-243	456
C-293, C-298	456
C-304, C-403	456
CFM-12	
(Amp. Mod.)	455
(Freq. Mod.)	2100
CG-56, CG-184	456
CG-508, CG-528	456
CG-674	456
CG-5206	456
CH-594	456
CX23, CX304	456
D-3	456
F-14	456
FM-12	
(Amp. Mod.)	455
(Freq. Mod.)	2100
G-44, G-45	456

(Cont'd)

PILOT—(Cont'd)

Model	kc
G-50 Series	456
G-56, G-57	456
G-162, G-162A	456
G-162B, G-163	456
G-163A, G-163B	456
G-174, G-175	456
G-180 Series	456
G-184, G-185	456
G-274, G-274J	456
G-284, G-350, G-352	456
G-353	456
G-528, G-529	456
G-506, G-509	456
G-528, G-529	456
G-562, G-563	456
G-576, G-577, G-664	456
G-665	456
G-584, G-585	456
G-750, G-752, G-753	456
G-4104, G-4105	456
H-11, H-12	455
H-64, H-65	455
H-134, H-135	455
H-151 (Series)	455
H-324	455
H-370	455
H-372, H-373	455
H-384, H-385	455
H393	456
H-450, H-470	455
H-454, H-455	455
H-474, H-475	455
H-480	455
H-484, H-485	455
H-550	455
H-554, H-555	455
H-590	455
H-594, H-597	455
H-650	455
H-651	455
H-660	455
H-664, H-665	455
H-710	455
H-760	455
H-762, H-763	455
H-870	455
H-874, H-875	455
H-6204	455
HX-304	456
LRFM-12	
(Amp. Mod.)	455
(Freq. Mod.)	2100
M-2203, M-2205	456
NRFM-12	
(Amp. Mod.)	455
(Freq. Mod.)	2100
P-23, P-25	456
P-63, P-393	456
PG-184	456
PG-524	455
PG-528	456
PH-393	456
PH-474, PH-484	456
PH-664	456
PH-874	456
PX23, PX304	456
QG-184	456
QG-584	456
QG-674	456
QX-304	456
RG-184	456
RG-674	456
RX-304	456
S-148, S-164	175
S-295, S-393	456
S-623, S-623J	456
SG-184	456
SG-674	456
T-101, T-102	455

(Cont'd)

PILOT—(Cont'd)

Model	kc
T-121, T-122	455
T-1252, T-1351	455
T-1451, T-1452	455
T-1584, T-1664	455
T-1764, T-1854	455
TG56, TG162, TG184	456
TG-462, TG-508	456
TG-528, TG-584	456
TG-674, TG-752	456
TG-44, TG-852	455
TG-5206	456
TH-150	455
TH-151, TH-372	456
TH-454	456
TH-474, TH-484	456
TH-554, TH-594	456
TH-597, TH-650	455
TH-651, TH-664	456
TH-762, TH-874	456
TP423	456
TP-1062, TP-1862	455
VG352, VX201, VX203	456
WG-352	456
WH-141	456
WRFM-12	
(Amp. Mod.)	455
(Freq. Mod.)	2100
WX-201, WX-203	456
X-23, X-41	456
X-48, X-49 (Sold in Europe only)	456
X-63, X-65 (Sold in Europe only)	456
X-68, X-69	456
X-73, X-75 (Sold in Europe only)	456
X-105, X-114, X-115	456
X-201, X-203, X-205	456
X-300, X-304, X-305	456
X-1584	455
X-1684	455
X-2253, X-2255	456
XG-56	456
XG-184	456
XG-674	456
XG-5206	456
Y-41, Y-43	456
Y-45 (Sold in Europe only), Y-48	456
YRFM-12	
(Amp. Mod.)	455
(Freq. Mod.)	2100
2	456
8, 10-AC, 11	115
12 (Chassis)	
(Amp. Mod.)	455
(Freq. Mod.)	2100
18	456
20 Series	456
23, 25	456
28	115
33	456
39	115
‡ §41	456
§43	456
45, 48	456
53, 55	456
* † ‡63	456
‡65	456
‡68, ‡69	456
73	456
‡75	456
81	482
84, 88	115
92	115
93	456
94	115
103	456

(Cont'd over)

PILOT—(Cont'd)

Model	kc
†105	456
108, 109	456
* ‡114	456
‡115	456
123, 125	456
148	456
*149	175
*153, 155	456
*183, 185	456
193, 195	456
*203, 205	456
*213	456
*215	456
223, 225	456
*243	456
253, 255	456
268, 269, 284	456
290 Series	456
*293	456
294, 295	456
*298	456
300	456
*304	456
305	456
360 Series	456
364, 365 (Sold in Europe only)	456
390, 393	456
†393	456
395	456
400 Series	456
*403	456
405	456
420 Series	456
423, 425	456
605	175
620 Series	456
623, 623J	456
625, 625J	456
1010	115
2108, 2109	456
2203, 2205	456
2250 Series	456
2253, 2255	456

See also corresponding listings under:
* Letter "C" models, such as C-63, C-114, etc.
† Letter "P" models, such as P-63, P-393, etc.
‡ Letter "X" models, such as X-41, X-63, etc.
§ Letter "Y" models, such as Y-41, Y-43, etc.

PIONEER
(See Radolek)

PLAZA MUSIC CO.

Model	kc
6 tube Super	175
7 tube Super	175
549	456
711	175

PLYMOUTH—Philco Receivers
(Plymouth, Division of Chrysler Corp.)

(See Plymouth receiver listings under Philco)

PONTIAC MOTOR CO.
(See United Motors Service)

PORT-O-MATIC
(Port-O-Matic Corp.)

(Fidel-O-Matic, Port-O-Matic. Successors to Lehman Radio Salon, Inc.)

Model	kc
8P (Port-O-Matic)	465
10, 12 Series 1935 (Port-O-Matic)	175
10, 12 Series 1936 (Port-O-Matic)	470
18 (Port-O-Matic)	465
80 (Port-O-Matic)	465
100, 101 (Port-O-Matic)	465
110 (Port-O-Matic)	465
110 (European Model) (Port-O-Matic)	465
112 (Port-O-Matic)	465
112 (European Model) (Port-O-Matic)	465
210, 212 (Port-O-Matic)	465
250 (European Model) (Port-O-Matic)	465
Series 500 (1936) (Fidel-O-Matic)	456
Series 600 (1937) (Fidel-O-Matic)	456
600 (Port-O-Matic)	465
Chassis P-8	456
P2LW	456

POSTAL

Model	kc
T	175

PRECISION

Model	kc
6 Tube A-W	465
8 Tube A-W	465
511	465
644, 645	465
845	465

PREMIER

Model	kc
Auto Pal	175

PRO
(See Hammarlund)

RADIETTE
(See Keller-Fuller)

RADIOBAR
(Radiobar Co. of America)

(See also listings under Philco)

Model	kc
1-116 (Philco 38-116 set)	470
2-1 (Philco 38-1 set)	470
3-3 (Philco 38-3 set)	470
4-4 (Philco 38-4 set)	470
5-9 (Philco 38-9 set)	470
6-9 (Philco 38-9 set)	470
12TP (Philco 39-12T set)	470
19PA (Philco 39-19F set)	470
19PCS (Philco 39-19F set)	470
19PF (Philco 39-19F set)	470
19TP (Philco 39-19T set)	470
30PCX (Philco 39-30X set)	470
40PCX (Philco 39-40 set)	470
40-10 (Philco 38-10 set)	470
50-9 (Philco 38-9 set)	470

(Cont'd)

RADIOBAR—(Cont'd)

Model	kc
60-7 (Philco 38-7 set)	470
105	465
106	262.5
107 (Philco 37-84 set)	470
116PCX (Philco 39-116 set)	470
210, 210B, 210C	262
504 (Philco 37-60 set)	470
504 (Philco 37-61 set)	470
504 (Philco 37-610 set)	470
504 (Philco 37-620 set)	470
504 (Philco 37-640 set)	470
505	175
506	262.5
507 (Philco 37-610 set)	470
507 (Philco 37-620 set)	470
507 (Philco 37-640 set)	470
507 (Philco 37-650 set)	470
507 (Philco 37-660 set)	470
508	262
508, No. 1	262
508, No. 3	262.5
510	262
510, No. 4	262.5
510, No. 5	262.5
510 (Philco 37-610 set)	470
510 (Philco 37-620 set)	470
510 (Philco 37-640 set)	470
510 (Philco 37-650 set)	470
510 (Philco 37-660 set)	470
510 (Philco 37-670 set)	470
515 (Philco 37-610 set)	470
515 (Philco 37-620 set)	470
515 (Philco 37-640 set)	470
515 (Philco 37-650 set)	470
515 (Philco 37-660 set)	470
515 (Philco 37-670 set)	470
526	262.5
528	262
528, No. 1	262
528, No. 3	262.5
528 (Philco 37-610 set)	470
528 (Philco 37-620 set)	470
528 (Philco 37-640 set)	470
528 (Philco 37-650 set)	470
528 (Philco 37-660 set)	470
528 (Philco 37-670 set)	470
536 (Philco 37-610 set)	470
536 (Philco 37-620 set)	470
536 (Philco 37-640 set)	470
536 (Philco 37-650 set)	470
536 (Philco 37-660 set)	470
536 (Philco 37-670 set)	470
550 (Philco 37-670 set)	470
550 (Philco 37-PC670 set)	470
550 (Philco 37-PC675 set)	470

RADIO CHASSIS INC.

Model	kc
Auto	175
A-5-D, A-6-D	175
AC-36	175
AL-33	456
L-5-D	456
L-6-D	115
L-6-W	125
LSA-36, LSA-37	175
QAC-36	175
SB-37, SL-853	456
V-6	175
2, 5	175

RADIO CIRCULAR CO.

Model	kc
5 tube AW	456
ACE 5 (Batt.)	456
ACE 5 (A-C)	456
ACE 817	456
W	456

RCA and RCA-VICTOR (RCA Mfg. Co. Inc., *(USA)*

Model	kc
S. W. Adapter	1000
1-AX	455
1-AX2	455
AVR- 1	445
HF- 1	455
HF- 2	455
SW- 2	1075
SWA- 2	1075
R- 3-B	175
R- 3-C	175
4-T	460
4-X	460
4-X3	460
4-X4	460
HF- 4	455
4-QB	455
4-QB4	455
R- 4	175
T- 4-8	460
T- 4-8A	460
T- 4-9	460
T- 4-9A	460
5-BT	460
5-M	260
AVR- 5-A	445
P- 5	455
5-Q1	455
5-Q2	455
5-Q2X	455
5-Q4	455
5-Q5	455
5-Q5E	455
5-Q6	455
5-Q8	455
5-Q55	455
5-Q56	455
5-Q66	455
5-T	460
5-T1	460
5-T4	460
5-T5	460
5-T6	460
5-T7	460
5-T8	460
5-U	460
5-X	460
5-X2	460
5-X3	460
5-X4	460
5-X5	455
5-XA3	460
5-XA4	460
5-X51	455
5-X5W	455
T- 5-2	460
T- 5-4	460
TRK- 5	455
TT- 5	455
6-BK	460
6-BK6	460
6-BT	460
6-BT-6	460
HF- 6	455
6-K	460
6-K1	460
6-K2	460
6-K3	460
6-K10	460
6-K (auto radio)	260
6X2	455

(Cont'd)

RCA and RCA-Victor *(USA)* —*(Cont'd)*

Model	kc
6-M2 (auto rad.)	260
6-Q1	455
6-Q4	455
6-Q7	455
6-Q8	455
6-T10	460
6-T2	460
6-T5	460
6-7	460
BC- 6-4	460
BC- 6-6	460
BT- 6-3	460
BT- 6-5	460
BT- 6-10	460
C- 6-2	460
C- 6-8	460
C- 6-12	460
H- 6 (Hudson)	260
HF- 6	455
R- 6	175
T- 6-1	460
T- 6-7	460
T- 6-9	460
T- 6-11	460
7-K	460
7-K1	460
7-T	460
7-T1	460
7-U	460
7-U2	460
7-X	460
7-X1	460
BC- 7-9	460
BT- 7-8	460
BT- 7-9	460
C- 7-6	460
C- 7-14	460
D- 7-7	460
7-Q4X	455
R- 7	175
R- 7-A	175
R- 7-DC	175
R- 7-LW	110
T- 7-5	460
T- 7-12	460
8-BK	460
8-BK6	460
8-BT	460
8-BT6	460
8-K	460
8-K1	460
8-K11	460
8-M (auto rad.)	455
8-M1 (auto rad.)	260
8-M2 (auto rad.)	260
8-M3 (auto rad.)	260
8-M4 (auto rad.)	260
8-Q1	455
8-Q2	455
8-QB	455
8-QBK	455
8-QU5C	455
8-QU5M	455
8-T	460
8-T2	460
8-T10	460
8-T11	460
8-U	460
U- 8	455
8-U2	460
C- 8-15	460
C- 8-17	460
C- 8-19	460
C- 8-20	460
D- 8-28	460
HF- 8	455
R- 8	175
R- 8-DC	175

(Cont'd)

RCA and RCA-Victor *(USA)* —*(Cont'd)*

Model	kc
T- 8-14	460
T- 8-16	460
T- 8-18	460
9K	460
9-K1	460
9-K2	460
9-K3	460
9-K10	460
9-M1 (auto rad.)	455
9-M2 (auto rad.)	455
9-Q1	455
9-Q4	455
9-QK	455
9-SX1	456
9-SX2	456
9-SX3	456
9-SX4	456
9-SX5	456
9-SX6	456
9-SX7	456
9-SX8	456
9-T	460
9-T (Gen. Purp.) AW	455
9-TX1	455
9-TX2	455
9-TX3	455
9-TX4	455
9-TX5	455
9-TX21	455
9-TX22	455
9-TX23	455
9-TX31	455
9-TX32	455
9-TX33	455
9-TX50	455
9-TX50M	455
9-U	460
9-U2	460
C- 9-4	460
C- 9-6	460
D- 9-19	460
R- 9	175
R- 9-9	175
R- 9-DC	175
T- 9-7	460
T- 9-8	460
T- 9-9	460
T- 9-10	460
TRK- 9	455
U- 9	455
Victor 9-18	180
Victor 9-54	180
BP-10	455
10-K	460
10-K1	460
10-K11	460
10-Q1	455
10-T	460
10-T11	460
10-X	455
R-10	175
R-10-DC	175
T-10-1	460
T-10-3	460
U-10	455
UT-10	455
C-11-1	460
C-11-3	460
D-11-2	460
11-Q4	455
11-QJ	455
11-QK	455
11-QU	455
R-11	175
R-11-AC	175
T-11-8	460
11-X1	455

(Cont'd over)

RCA and RCA-Victor *(USA)* —*(Cont'd)*

Model	kc
12-AX	455
12-AX2	455
12-Q4	455
12-QK	455
12-QU	455
R-12	175
TRK-12	455
U-12	455
C-13-2	460
C-13-3	460
13-K	460
14-AX	455
14-BT1	455
14-BT2	455
14-BK	455
14-X	455
AVR-15 (Aircraft)	95
AVR-15A (Aircraft)	95
15-BP	455
C-15-3	460
C-15-4	460
15-K	460
15-U	460
15-X	455
16-K	455
RE-16	175
RE-16-A	175
16-T2	455
16-T3	455
16-T4	455
16-X	455
16-X1	455
16-X2	455
16-X3	455
16-X4	455
16-X11	455
16-X13	455
16-X14	455
17-K	455
RE-18	175
RE-18-A	175
18-T	455
19-K	455
RE-19	175
RE-19-AC (AVC)	175
Q-20	455
RE-20	175
U-20	455
Q-21	455
R-21	175
D-22-1	460
D-22-1A	460
R-22	175
RO-23 (Broadcast IF)	175
RO-23 (SW C'nv'tr.)	1075
24BT-1	455
24BT-2	455
25BK	455
25BP	455
25BT-2	455
25BT-3	455
R-25-DC	175
U-25	455
26BP	455
U-26	455
RAE-26	175
26X-1, 26X-3	455
26X-4	455
27K	455
R-28	175
R-28-BW	175
R-28-BWC	175
R-28-P	175
28T	455
28X	455
28X5	455
29K	455
29K2	455

(Cont'd)

RCA and RCA-VICTOR —*(U. S. A.)*—*(Cont'd)*

Model	kc
M-30 (auto radio)	175
U-30	455
M-31	175
P-31	175
M-32 (auto radio)	175
M-34 (auto radio)	175
R-37	175
R-37-P	175
R-38	175
R-38-P	175
BT-40	455
R-40-P	175
RE-40	175
RE-40-P	175
40-X30	455
40-X31	455
40-X50	455
40-X52	455
40 X55	455
40-X57	455
U-40	455
BK-41	455
BT-41	455
BT-42	455
U-42	455
R-43	175
U-43	455
U-44	455
45-E Series	455
45-X1	455
45-X2	455
45-X3	455
45-X4	455
45-X5	455
45-X6	455
45-X11	455
45-X12	455
45-X13	455
45-X16	455
45-X17	455
45-X18	455
45-X111	455
45-X112	455
45-X113	455
U-45	455
46-X1	455
46-X2	455
46-X3	455
46-X11	455
46-X12	455
46-X13	455
46-X21	455
46-X23	455
46-X24	455
U 46	455
Radiola B-50	455
K-50	455
K-50 (2nd)	455
M-50	455
R-50	175
U-50	455
R-51-B	175
Radiola B-52	455
R-53-B	175
BP-55	455
R-55	175
T-55	455
55X	455
BP-56	455
T-56	455
RAE-59	175
K-60	455
M-60	455
Radiola 60	180
T-60	455
K-61	455
K-62	455
Radiola 62	180

(Cont'd)

RCA and RCA-VICTOR —*(U. S. A.)*—*(Cont'd)*

Model	kc
T-62	455
T-63	455
Radiola 64	180
T-64	455
T-65	455
Radiola 66	180
67-M (auto rad.)	260
67-M1 (auto rad.)	260
67-M2 (auto rad.)	260
67-M3 (auto rad.)	260
Radiola 67	175
RAE-68	175
M-70	260
R-70	175
R-71	175
R-71B	175
R-72	175
R-73	175
R-73A	175
R-74	175
R-75	175
R-75-A	175
R-76	175
R-77	175
R-78	175
RAE-79	175
K-80	455
Radiola 80	175
RE-80	175
T-80	455
K-81	455
RE-81	175
K-82	455
Radiola 82	175
84-BT	460
84-BT6	460
RAE-84	175
BP-85	455
85-BK	460
85-BT	460
85-BT6	460
85-E	460
85-K	460
85-T	460
85-T1	460
85-T2	460
85-T5	460
85-T8	460
86-BK	460
86-BT	460
86-E	460
86-K	460
86-K7	460
86-T	460
86-T1	460
86-T2 (Early)	460
86-T2 (Late)	455
86-T3	460
86-T4	460
86-T6	455
86-T44	460
86-X	460
86-XX	460
Radiola 86	175
87-EY	460
87-K	460
87-K1	460
87-K2 (Early)	460
87-K2 (Later)	455
87-T	460
87-T1	460
87-T2 (Early)	460
87-T2 (Later)	455
87-X	460
87-Y	460
88-K	460
R-90	175
R-90-P	175

(Cont'd)

RCA and RCA-VICTOR
—(U. S. A.)—(Cont'd)

Model	kc
TRK-90	455
94-BK	455
94-BK1	455
94-BK2	455
94-BP1	455
94-BP4	455
94-BP61	455
94-BP62	455
94-BP64	455
94-BP80	455
94-BP81	455
94-BT	455
94-BT1	455
94-BT2	455
94-BT6	455
94-BT61	455
94-X	455
94-X1	455
94-X2	455
95	455
95-E	455
95-T	455
95-T1	455
95-T5	455
95-T5LW	455
96-BK6	455
96-BT6	455
96-E	455
96-E2	455
96-K	455
96-K2	455
96-K5	455
96-K6	455
96-T	455
96-T1	455
96-T2	455
96-T3	455
96-T4	455
96-T5	455
96-T6	455
96-T7	455
96-X1	455
96-X2	455
96-X3	455
96-X4	455
96-X11	455
96-X12	455
96-X13	455
96-X14	455
97-E	455
97-K	455
97-K2	455
97-KG	455
97-T	455
97-T2	455
97-X	455
97-Y	455
98-EY	455
98-K	455
98-K2	455
98-T	455
98-T2	455
98-X	455
98-YG	455
99 K	455
99-T	455
RCA-100	460
V-100	455
RCA-101	460
V-101	455
M-101 (auto radio)	175
U-101	460
U-102-E	460
V-102	455
103	460
U-103	460
M-104 (auto radio)	175
K-105	455

(Cont'd)

RCA and RCA-VICTOR
—(U. S. A.)—(Cont'd)

Model	kc
M-105 (auto radio)	175
U-105	460
U-106 (Early)	460
U-106 (Later)	455
M-107 (auto radio)	175
U-107	460
M-108 (auto radio)	175
U-108 (Early)	460
U-108 (Later)	455
M-109 (auto radio)	175
U-109	460
110-K	455
RCA-110	175
111-K	455
RCA-111	175
U-111	455
112	175
112-A	175
114	175
115	175
U-115	455
M-116 (auto radio)	175
117	460
118	460
119	460
M-119	460
U-119	455
120	175
TRK-120	455
121	370
U-121	455
122	370
U-122-E	455
M-123 (auto radio)	175
U-123	455
124	175
U-124	455
125	460
U-125	455
126-B	460
U-126	455
U-127	370
U-127-E	455
128	460
128-E	460
U-128	455
U-129	455
K-130	455
U-130	455
U-132	455
U-134	455
135-B	460
V-135	455
ACR-136	460
140	445
141	445
141-E	445
142-B	175
143	460
V-170	455
ACR-175	460
V-175	455
V-200	455
V-201	455
VHR-202	455
V-205	455
VHR-207	455
210	175
211	460
211K	455
212	455
214	460
220	175
221	370
222	175
223	175
224	460
224-E	460

(Cont'd)

RCA and RCA-VICTOR
—(U. S. A.)—(Cont'd)

Model	kc
225	460
226	460
235-B	460
236-B	460
240	445
241-B	175
242	460
243	460
260	175
261	175
262	460
263	460
280	175
281	460
300	455
V-300	455
301	455
V-301	455
302	455
V-302	455
VHR-307	455
310	175
DUO-320	370
DUO-321	370
DUO-322	460
DUO-322-E	460
327	370
330	175
331	175
340	445
340-E	445
DUO-340	445
DUO-341	460
342	460
DUO-380	175
DUO-380-HR	175
DUO-381	460
405	455
V-405	455
VHR-407	455
RC-427-F (Chassis)	455
427-G (Chassis)	455
RC-500	455
501	455
510	455
511	455
512	455
513	455
Radiola 516, 517	455
520	455
522	455
Radiola 526, 527	455
Radiola 560-P	455
Radiola 566-P	455
810-K	460
810-K1	460
810-T	460
810-T4	460
811-K	460
812-K	460
813-K	460
816-K	460
910-KG	455
911-K	455
ER-1240-A2	175
23590-2	175

RCA-Victor (CANADIAN)

Model	kc
R-6, R-7	175
R-7-A, R-8, R-8-A, R-9-A	175
R-10, R-12, R-15	175
R-20, R-20R	175
R-21, R-22	175
R-28	175
R-29, R-30, R-31	175
RE-33	175
M-34	175
R-35, R-37, RE-37	175
R-39, RE-41	175
R-48, R-49	175
R-50, R-52	175
R-53, R-54, R-56	175
RE-57, RAE-59	175
R-68, R-78	175
Radiola 80	175
RE-80	175
Radiola 82	175
RAE-84	175
Radiola 86	175
R-87, R-88	175
Radiola 90	175
Radiola 101	460
R-104, R-105	175
R-107, R-109	175
RO-112	175
M-116	175
118	460
122	370
M-123	175
126-B	175 or 460
128	460
R-128	175
135-B	460
140	445
143	460
211	460
221	370
222	175
223-B	175 or 460
224	460
235-B	460
242, 262	460
280	175
281	460
321	370
331	175
340	445
381	460

RADIO MFG. ENGINEERS, INC. (RME)

Model	kc
Aviation	465
RME-69	465
U. H. F.	465
9D	465
69	465
69-LS1	465
70	465
510X	10000

RADIO PRODUCTS CORP. (Dayrad)

Model	kc
A1, A3	456
A31, A126, A128	456
A346	456

(Cont'd)

RADIO PRODUCTS CORP —(Cont'd)

Model	kc
AM357, AM387	456
AM458, AM488	456
AM557, AM587	456
AM658, AM688	456
AM757, AM786, AM787	456
AZ282, AZ393	456
AZ482, AZ593, AZ594	456
B2	456
BA41	456
B125, B127, B129	456
B225, B227	456
B325, B327	456
CL583	456
CL684, CL783	456
L2, L4	456
L5, L6	456
L7	456
L266, L477, L567	456
L668, L767	456
M1	456
M169, M351, M551	456
ML156, ML215A	456
ML266, ML366	456
ML477, ML481	456
MX210, MX218, MX238	456
MX239, MX241	456
U6, U6B	175
X8	456
X140, X141, X423	456
X541, X641	456
X718, X813	456
Z2, Z3	456
Z4, Z5	456
Z242, Z344	456
Z442, Z443	456
Z544, Z545	456
4A, 5A, 7A	456
5E, 5F	456
6D, 7G	456
55	456
66, 69	175
77, 78	175
88	175
100C, 132, 137X	456
150, 150X	456
155, 155X	456
171, 171X	456
190	456
1907, 1939, 1954X	456
1957	456
7169	456

RADIO PRODUCTS SALES CO.

(See Clinton, Clipper)

RADIOTROPE

(See also U. S. Radio & Television Co.)

Model	kc
70-R, 71-R	262
72-R, 73-R	262

RADIO VISION CORP.

Model	kc
AX	456

RADOLEK (Radolek Co.) (Pioneer, Radolek)

Model	kc
Custom Craft	175
Octomatic	175
5 Tube Duola	465
6 Tube Duola	465
8 Tube 2V. Batt.	175
10 Tube Magic Messenger	175
A17490, A17491	465
A17504	465
A17555, A17556	456
A17568, A17569	456
A17570, A17571	456
A17573, A17574	465
A17575, A17576	456
A17578, A17579	456
A17580, A17581	456
A17582, A17583	456
A17585, A17587	456
A17588, A17589	456
A17590, A17591	456
A17592, A17593	456
A17596, A17599	456
A17650 (auto radio)	262
A17651 (auto radio)	262
A17652 (auto radio)	262
A17653 (auto radio)	262
A17654 (auto radio)	262
A17655 (auto radio)	262
A17656 (auto radio)	262
A18000, A18001	455
A18003, A18004	455
A18006, A18007	465
A18009, A18010	455
A18011	1600
A18017, A18018	465
A18020	465
BF10150	262
BF10153	456
BF10154	262
BF10926	456
BF10927	456
BF10928	456
BF10929, BF10930	456
BF10934, BF10935	456
BF10936, BF10937	456
BF10938, BF10939	456
BF10940, BF10941	456
BF10942, BF10943	456
BF10944, BF10946	456
BJ10926	175
BJ10151	262
BJ10160	175
BJ10932, BJ10933	456
BJ10935, BJ10936	456
BJ10940, BJ10941	456
BJ10942, BJ10943	456
BJ10944, BJ10946	456
BJ10950, BJ10951	456
BJ10952	456
BJ10953	456
BJ10954	456
BJ10955, BJ10956	456
BJ10965	456
BJ10966	175
BJ11913	456
BJ11924, BJ11925	465
BJ11926	465
F10167, F10168, F10169	172.5
JB10947	456
JB10948	456
K16701, K16702, K16703	456
K16705, K16706	456
K16720, K16721	456
K16722, K16723	456
K16724, K16725	456
K16726, K16727, K16728	456
K16740, K16741	456

(Cont'd)

RADOLEK—*(Cont'd)*

Model	kc
K16742, K16743	456
K16744, K16745	456
K16746, K16747	456
K16748, K16749	456
K16750, K16751	456
K16752, K16753	456
K16754, K16755	456
K16756, K16757	456
K16758, K16759	456
K16770, K16771	465
K16772, K16773	465
K16774, K16775	465
K16776, K16777	465
K16778, K16779, K16780	465
K16790, K16791	465
K16825	175
K16835, K16836	262
K16837, K16838, K16839	262
N16702, N16703, N16704	456
N16729, N16731	456
N16732, N16733	456
N16734, N16735	456
N16736, N16737	456
N16738, N16739	456
N16760, N16761	456
N16762, N16763	456
N16765, N16766	456
N16767, N16768	456
N16781, N16782	456
N16785	456
N16800, N16801	260
N16803, N16805	260
N16815, N16815-660 (auto radio)	262.5
N16816, N16817	262.5
N16825, N16826	175
N16826-B661 (auto radio)	175
N16827, N16828, N16829	175
N16835, N16836	262
N16837, N16838	262
N16839, N16840	262
N16840-R6440 (auto radio)	262
R17510, R17512	456
R17515, R17516	456
R17517, R17518	456
R17520, R17521	456
R17522, R17523	456
R17524, R17526	456
R17527, R17528	456
R17530 (Batt.)	456
R17530 (AC-DC)	456
R17531, R17532	456
R17533, R17534, R17535	456
R17540, R17541	456
R17542, R17543	456
R17544, R17545	456
R17546, R17547, R17548	456
R17549	456
R17565, R17566, R17568	456
SR227	456
SR228	175
SR229	175
SR230	175
3F10926, 3F10927	456
3F10947	456
3F10948	456
3F10986	456
3F10987	456
3F10988	456
4F10928	456
14E10150	175
14E10151	175
14E10152	175
14E10160, 14E10161	260
14E10162, 14E10163	260
14E10964	456
14E10968, 14E10969, 14E10970	456
14E10973, 14E10974	456

(Cont'd)

RADIOLEK—*(Cont'd)*

Model	kc
14E10978, 14E10979	175
14E10980	465
14E10981	465
14E10984 (470W)	370
14E10984 (714O)	465
14E10985 (470B)	370
14E10985 (7139)	465
14E10995, 14E10996	456
951	262
956, 958	465
10926, 10927	456
10928, 10943	456
10951	262
10956	465
10963, 10964	456
10968, 10969	456
10970, 11908	456
11911	456
11935	465
11947	456

REMINGTON
(See Dunn-Hall)

REMLER
(Remler Co., Ltd.)

(Also see listings under Norco)

Model	kc
Best "45-Kc"	45
Best "115-Kc"	115
4	250
10 Reflex	180
10-3	250
10-4	450
11	180
12, 13	450
14	450
15	180
15-3, 15C	180
17, 18, 19	180
21-3	250
21-4	450
26, 27, 28	450
29	115
30	450
35 (auto radio)	450
36, 37 (auto radios)	250
38, 39, 40, 41	450
42	450
42SW	450
43, 44, 45	450
46, 47	450
48	450
49	450
52, 53, 53C, 54	450
55, 56	450
60, 61, 62	450
63, 64, 65	450
66	450
71, 72	450
73	450
88, 89, 89C	450
91, 158	450
171	450
179	450
179PB	450

(Cont'd)

REMLER—*(Cont'd)*

Model	kc
462, 465	450
466, 470	450
479	450

REPUBLIC INDUSTRIES
(Skyhawk. Also see High-Frequency Labs.)

Model	kc
Master (1935)	175
Skyhawk Patrician	175
Skyhawk RC-5, RC-6	175
AR-6	175
BP-SE	175
BP-5E	115
CR-7	175
CS-6	115
MS	175
SL-5, SL-5-D	175
SL-6	115
SL-6-D	175
SLD-6, SLS-D	175
TL-6C, TR-5B	175
4B6	175
42	175
50-L	115
50-S	175
51	175
55, 56	456
311, 316	456

R. K. RADIO LABS., INC.
(See Arkay)

RME
(See Radio Mfg. Engineers, Inc.)

ROAD CHIEF
(See Detrola Radio & Telev. Corp.)

ROAD MASTER
(See Detrola)

ROAMER
(See listings under Knight)

ROAMIO
(See Crosley)

ROYAL
(Champion Radio Labs)

Model	kc
5238	465
5338	465
6338	465
7338	465
8338	465

RUDOLPH WURLITZER
(See listings under Wurlitzer)

SARA
(J. & L. Sara Co., Inc.)

Model	kc
SJ-4	175
SJ-4K	125
S-39B	125
S-41L	125
S-42B	125
S-47	125
S-48	125
S-49	125
S-51	456
S-55	456

SARGENT

Model	kc
20	525

SAVIL
(Savil Radio Engineering Corp.)

Model	kc
L52, SL5	415
SL62	456
W52	456
W72	456
715	450
815	460
900A	456
915	456

SCOTT
(E. H. Scott Radio Labs., Inc.)

Model	kc
All-Wave Deluxe (12 tubes)	465
All-Wave Fifteen (15 tubes)	465
All-Wave Super	470
Full Range High Fidelity (23 tubes)	465
Phantom (18 tubes)	465
Phantom DeLuxe	5250
Philharmonic	5250
Philharmonic (30 tubes)	465
A. C. Ten-A	475
A. C. Ten-B	475
Sixteen	465
Eighteen	465
XV-Model A	465
XV-Model B	465
XV-Model C	465
Super Twelve	455

SEARS, ROEBUCK & CO.
(See listings under Silvertone)

SENTINEL
(See listings under Sentinel Radio Corp.)

SENTINEL RADIO CORP.

Model	kc
1-U-C-94UL	455
1-U-C-194UL	455
6A	465
7M	465
10M, 10MF	370
11M	465
14A, 14A72, 14A86	465
19A, 19A68, 19A71	465
20A, 20A71, 20A73	465
25A72, 25A74	465
30, 31	175
31B, 31B72, 31B74	465

(Cont'd)

SENTINEL RADIO CORP. —(Cont'd)

Model	kc
32B, 32B69	465
33B, 33B70, 33B71	465
34B, 34B71, 34B73	465
35B, 35B70, 35B72	465
36L, 36L71, 36L673	465
37B, 38B, 39B	465
40A, 40B, 44A	465
46A, 46AC, 46ACE	465
46AT, 46ATE	465
47A, 47ACE, 47ATE	465
48A	465
49B, 50B	465
51U	465
52A, 52AC, 52ACE, 52ACT	465
52AT, 52ATE	465
53A, 54A	465
55U	465
56U	465
57A, 57ACE, 57ATE	465
58A, 59U	465
60B, 60BC, 60BT	465
61, 62, 63	175
63B, 63BC, 63BT	465
65B, 65BC, 65BT	465
66B, 66BCE, 66BTE	465
67L, 67LC, 67LT	465
68B, 68BC	465
68BE, 68BCE	465
68BT, 68BTE	465
69U	465
70A, 70AC, 70AT	465
71U, 72A, 72AE	465
72AT, 72ATE	465
73B, 73BT, 74A	465
74AE, 76A, 76AC	465
78B, 78BE, 78BCE	465
78BTE	465
80B, 80BC, 80BCT	465
80BT	465
81, 81P	175
82 (245)	175
82P	175
82A, 82AC, 82AE	465
82AT, 83UE, 85	465
85UE, 86ACE	465
86AE, 86ATE	465
87AE, 88AE, 90B	465
90BC, 90BCT, 90BT	465
91B, 92AE, 93L	465
93LC, 93LT, 95BC	465
95BT, 96BCE, 96BE	465
96BTE, 97L	465
97LC, 97LT	465
98AE, 99AE	465
100X	465
101A	465
106A, 106B, 107A	465
107AE	465
108	175
108A, 108B, 109	175
109B	465
110	175
110A	465
114	175
116	465
118	175
118B, 118BCT, 118BT, 119B	455
119BCT, 119BE, 119BT	455
124A, 124AA, 124ACT	455
124AE, 124AT	455
125A, 125ACE, 125AE	455
125ATE	455
125	525
127B, 127BC, 127BCT, 127BT	455

(Cont'd)

SENTINEL RADIO CORP. —(Cont'd)

Model	kc
128B	455
130B, 130BC, 130BE, 130BT	455
137U, 137UT, 138AE, 139UE	455
140B, 140BC, 140BE, 140BT	455
141AE, 142A, 142AE, 142AT	455
143L, 143LC, 143LT, 144X	455
144XC, 144XE, 144XT	455
145AE, 147U, 148A	455
148AE, 149, 149AE	455
151BL, 158AE	455
159AE, 160BL	455
161U, 162U	455
163BL, 167U, 168B	455
175B, 176B, 177U	455
178BL, 180XL, 181BL	455
184U, 184UE, 185A	455
185AE, 186B, 186BE	455
189L, 190A, 190AE	455
191B, 191BE, 194UL	455
195UL, 197X, 198A	455
198AE, 199A, 199AE	455
200X, 201XL, 202BL	455
203UL, 204A, 204AE	455
205BL, 206A, 206AE	455
261	175
263	265
500, 501, 502	465
510	265
513	262
520, 521	175
530, 540	265
550	265
560, 560TV, 561	265
570	465
590	465
599	265
600	265
601, 602, 603	265
610	265
614	175
620, 622	465
623, 624	465
630	465
634, 635	465
660	465
810	175
814	265
1010, 1016, 1017	175
1020A, 1030A	115
1040	465
1046	465
1050, 1060	465
4300	465
4400	370
4500	465
5000, 5100	465
5211	465
5500	370
5600	265
5628	465
5700, 5700B	465
5721	465
5800	465
5850	465
6000	265
6100, 6101, 6102	465
6200	465
6232, 6234, 6241	465
6300	465
6313	465
6315	465
6317	465

(Cont'd)

SENTINEL RADIO CORP. —(Cont'd)

Model	kc
6321, 6323	465
6700, 6800, 6900	465
7100, 7100B	465
7150	465
7200, 7200B	465
7700	465
7732	465
7741	465
8100B, 8200, 8200B	465
9100	465

SETCHELL CARLSON
(Setchell Carlson Inc.)

Model	kc
23	456
28	465
29	456
32, 33	456
40, 41	456
44	465
45	456
50, 51, 52	456
60, 60-S	456
61, 62	465
63	456
66, 68, 68-S	465
70, 71	456
80	456
210	456
211, 212	465
220	465
221, 221AC	456
222	465
225, 225AC	465
230	465
253	175
330	465
331	456
332	465
333, 335	456
401, 405	175
407, 408	465
410, 510	456
588	456
600, 602, 610	465
620	465
621	456
621AC	456
622	465
630, 930	465
4017	465

SHELLEY RADIO CO.

Model	kc
5, 6	460
34	460
35C-AW	465
37C	458
48	460
65, 67, 75	460

SHOWBOX
(See Crosley)

McMURDO SILVER
(McMurdo Silver Inc.)
Orpheon, Silver)

Model	kc
Masterpiece I	465
Masterpiece II	465
Masterpiece III	465
Masterpeice IV	465
Masterpiece V	465
Masterpiece VI	465
Orpheon	472
Prof. 5C	465
Prof. 5-D	465
World Wide Nine	465
3A, 5B	465
15-16	465
15-17	472

SILVER
(See listings under McMurdo Silver, directly above)

SILVER-MARSHALL
(Silver-Marshall Mfg. Co.)

Model	kc
All World DeLuxe— Kc tuning range (540-25,000)	465
All World 5	465
Bearcat Midget	175
Round World 35	465
Super Air Flight	465
A, B, C, D	175
E, F, G	175
H-8	465
J, JT, K, KB	175
Q	175
Q DeLuxe, Q1, Q2	465
R, R-T	465
V	175
X, Y	465
Z-DeLuxe	472.5
Z-10	465
Z-13	472.5
36-A, 37, 38	175
39 (Midget), 41	175
714, 716	175
724, 724 (DC)	175
726, 726SW	175
727	465
728	175

(Cont'd)

SILVER-MARSHALL—(Cont'd)

Model	kc
728SW	175
729 SW	465
738	175
738 (Converter)	1000
739 (Converter)	650
773, 782 (Midget)	175
1022, 1040	175
4801, 4802 (Early Models)	465
4801, 4802 (Late Models)	175

SILVERTONE
(Sears, Roebuck & Co.)

Model	kc
A-1	480
9 tube AVC	175
33	456
34	456
35	456
36	456
44, 47, 48, 50	175
50AVC, 51, 52	175
55	1000
56, 62	175
65, 69, 71, 73	175
76, 94, 95, 99	175
107HA6, 107HA62	465
301	455
550	265
566	465
603	460
604	445
606	465
666	465
671	455
701	455
709	465
719	465
771	455
802, 812	465
1082, 1083	445
1280, 1282	175
1294, 1296	175
1320, 1322, 1324	175
1326, 1326X	175
1340, 1360	175
1380, 1382, 1386	175
1390, 1400, 1402	175
1404, 1406, 1408	175
1430, 1442, 1446	175
1450, 1454, 1456	175
1462, 1470	175
1480, 1482, 1484	175
1490, 1500, 1502	175
1506, 1506A	175
1509A	175
1510, 1512X	175
1520	175
1521	455
1522, 1524X	175
1531	175
1560	175
1561	455
1562, 1564	175

(Cont'd over)

SILVERTONE—*(Cont'd)*

Model	kc
1570	175
1571	455
1572, 1574	175
1575, 1576	175
1580, 1582, 1584	175
1585, 1586	175
1588, 1589	175
1590, 1590A	175
1591	455
1592, 1592A, 1592B	175
1594, 1596	175
1597, 1598	175
1600	1000
1621	455
1626, 1630	175
1640, 1641	175
1650, 1652, 1654	175
1660	175
1661	455
1670, 1670B, 1675	175
1700	175
1704	480
1705	175
1706, 1707	480
1708	175
1708A	480
1709	175
1710, 1711	175
1711-A	480
1711-X	465
1712, 1713	175
1714, 1715, 1716	175
1720, 1721	175
1722, 1722X	175
1725, 1726, 1726X	175
1729, 1730 (auto radio)	175
1731	456
1732, 1732X	175
1733	480
1743	465
1743A	456
1744, 1745	480
1750	175
1760	480
1771	455
1780	480
1781, 1781A	455
1801, 1801A	456
1802, 1802A	445
1803, 1803A	445
1804, 1805	480
1805A	175
1806, 1807	445
1808	480
1808A, 1809	175
1810	456
1811	175
1820, 1821	480
1822, 1823, 1824	445
1825	480
1825A	175
1826	480
1826A	175
1827, 1828	480
1829, 1830, 1831	445
1832	480
1832A	445
1833	175
1835	445
1840	480
1841	175
1842	480
1845	175
1850, 1850A, 1851	175
1852, 1853	480
1854, 1854A	175
1855, 1856	175
1857, 1857A, 1858	175

(Cont'd)

SILVERTONE—*(Cont'd)*

Model	kc
1859, 1859A (auto radio)	370
1860	465
1862, 1863	175
1864 (auto radio)	175
1865, 1866, 1867	175
1868, 1868A	175
1869, 1869X (auto radio)	456
1870	175
1871 (auto radio)	262
1900, 1903, 1903X	456
1904, 1904A	175
1905, 1906	175
1907	456
1908, 1909	175
1910	456
1911, 1912	175
1914, 1915	175
1917, 1918, 1918A	385
1919	175
1920	480
1921, 1922, 1922A	175
1923	175
1924	465
1925	465
1926	480
1927, 1927X	465
1928	480
1929	175
1930	456
1931, 1932, 1932A	175
1933, 1933A	175
1934	465
1935	456
1936	175
1937, 1937X	465
1938	175
1939, 1940	456
1941	262.5
1942, 1943, 1944	175
1945, 1946	385
1947, 1948	175
1949, 1949A (auto radios)	456
1953, 1953X	456
1954	175
1954X	456
1955	175
1956, 1957	456
1962	175
1964, 1964A, 1965	175
1967, 1967A, 1967C	385
1968, 1968A	385
1970, 1970A	456
1971 (auto radio), 1972	175
1978, 1980, 1980A	480
1981, 1981C	262.5
1981C4	262.5
1982, 1982A	175
1983, 1983A, 1984	175
1985	450
1986, 1987	262
1988	465
1989	465
1992, 1992A, 1993	175
1993X	465
1994	175
1995	456
1996	175
1998	262
1999	175
2011, 2051, 2061, 2411	455
2421, 2451, 2461, 2511	455
2541, 2551, 2611, 2641	455
2651, 2711, 2741, 2751	455
2761	455
3011, 3051, 3061, 3111	455
3151, 3161, 3211	455
3251, 3261, 3311, 3321	455
3351, 3361, 3411, 3421	455

(Cont'd)

SILVERTONE—*(Cont'd)*

Model	kc
3451, 3461, 3511, 3521	455
3551, 3561, 3611, 3621	455
3651, 3661, 3711, 3721	455
3751, 3761, 3811	455
3851, 3861	455
3972	465
4400, 4400A (auto radios)	465
4401, 4402	465
4403	262
4404	262
4405, 4405A	465
4406, 4407	465
4408, 4409	465
4410, 4411	465
4413	465
4418	456
4419, 4420	465
4421	456
4422, 4423, 4424	465
4425, 4426, 4426A	465
4427, 4427A	465
4428, 4428A, 4429	465
4430	456
4431, 4432	465
4433	465
4434	456
4435, 4436	465
4437, 4438	465
4439, 4440	465
4441, 4442, 4443, 4444	465
4445, 4446, 4446A, 4447	465
4448, 4448A	465
4449, 4450	465
4451, 4453, 4455	465
4456, 4459, 4461, 4462	465
4463, 4464	262
*4465	456 and 465
4466, 4467	456
4468	262
4469	456
4470	262
4471	456
4472, 4473	465
4477, 4478	465
4484	262
*4485	456 and 465
*4486	456 and 465
4486A, 4486B	456
4487, 4488, 4488A	465
4490	262
4492, 4493	465
4498, 4499	465
4519, 4520	465
4521	456
4522, 4523	465
4524, 4524A	465
4526, 4526A	465
4528	465
4528A, 4529	465
4531, 4532, 4533	465
4537, 4539	465
4542, 4542A, 4543, 4544	465
4546, 4546A	465
4548, 4548A	465
4549, 4550, 4559	465
4563, 4564	262
*4565	456 and 465
4566	262
4567	456
4569	262
4570, 4571, 4572	262
4575	262
4577	465
4584	262
*4585	456 and 465
4585A	465
*4586, 4586A	456 and 465
*4586B	456 and 465

(Cont'd)

SILVERTONE—*(Cont'd)*

Model	kc
4587, 4587A	465
4588, 4588A, 4588B	465
4589	262
4590	465
4593	262
4598	465
4600, 4601 (auto radios)	262
4602, 4603, 4604, 4605	465
4606, 4607, 4608, 4608A	465
4609, 4609A, 4610, 4611	465
4612, 4612A, 4613, 4614	465
4615, 4616, 4617	465
4619, 4620, 4620A	465
4621, 4621A, 4622, 4623	465
4624, 4625, 4626, 4627	465
4628, 4628A, 4629, 4629A	465
4630, 4631, 4632, 4632A	465
4633, 4633A, 4634, 4635	465
4636, 4637, 4638, 4638A	465
4639, 4639A, 4640	465
4641, 4641A, 4642, 4642A	465
4643, 4644, 4644A	465
4645, 4645A, 4646, 4647	465
4648, 4648A, 4649, 4649A	465
4650, 4651, 4652	465
4660	465
4662, 4663, 4664	465
4665, 4666, 4667	465
4668	456
4669	465
4675, 4677	465
4680, 4681	465
4684, 4685, 4686	465
4687, 4688	465
4700 (auto radio)	456
4720	465
4722, 4723, 4724	465
4726, 4728, 4728A	465
4730, 4740	465
4743, 4746	465
4748, 4748A, 4750	465
4760, 4761, 4762, 4763	465
4764, 4765, 4766, 4767	465
4769, 4770, 4771	465
4772, 4773, 4774	465
4776	460
4777, 4781	465
4783, 4784	465
4785, 4786, 4787, 4788	465
4789, 4790, 4791, 4792	465
4796	460
4798, 4799	465
5502	455
5511, 5511A, 5571, 5571A	455
5581, 5601A, 5621, 5611	455
5710, 5710A, 5711, 5711A	465
5721	455
5727, 5728	i-f on bands A, B, C & D is 465 i-f on bands E & F is 1560
5731, 5732, 5751	455
5752, 5753	465
5761	455
6000, 6001 (auto radios)	262
6002, 6003, 6004, 6005	465
6008, 6009, 6010	465
6012, 6013, 6014	465
6015, 6016, 6017	465
6018, 6019	465
6021, 6022, 6023, 6024	465
6025, 6028	455
6031, 6034	465
6036, 6038, 6040	465
6042, 6043, 6044	465
6045, 6046, 6047	465
6048, 6049, 6050	465
6052, 6053, 6054, 6055	465
6056, 6057	455
6064	465

(Cont'd)

SILVERTONE—*(Cont'd)*

Model	kc
6068, 6069, 6070	465
6071, 6072, 6073, 6074	465
6075	465
6076, 6077, 6079	465
6100, 6101 (auto radios)	262
6104 (auto radio)	455
6119, 6120	455
6121, 6122, 6123	465
6124, 6125	465
6126, 6127, 6128, 6130	455
6131, 6132	465
6133	455
6134, 6135, 6136	465
6137, 6138, 6139	465
6140	465
6141	455
6142, 6144	465
6146, 6148, 6150	465
6151	455
6152, 6153	
Chassis No. 101.537	465
Chassis No. 101-537-1	455
6155, 6156	455
6157	465
6158, 6159, 6160, 6161	455
6162, 6163, 6164, 6168	465
6170, 6171, 6172, 6173	465
6175	455
6176	465
6177, 6178, 6179, 6185	455
6190	260
6192, 6199, 6200, 6201	455
6202, 6203	455
6206	465
6208, 6209	455
6210	465
6214, 6218, 6250, 6251	455
6252, 6253, 6254, 6256	455
6260, 6261, 6262, 6263	455
6264, 6265, 6266, 6270	455
6271, 6272, 6274	455
6275, 6276, 6277	465
6302, 6303, 6306-3G, 6320	455
6321	455
6322, 6323, 6324, 6325	455
6327, 6329, 6337, 6346	455
6346A, 6350, 6351, 6352	455
6353, 6354, 6355, 6356	455
6357, 638, 6368, 6372	455
6373, 6382, 6403, 6404	455
6405, 6406, 6407, 6408	455
6409, 6421, 6424, 6425	455
6437, 6437A, 6438, 6438A	455
6439, 6441, 6446, 6447	455
6449, 6492, 6496, 6497	455
6541, 6551, 6561, 6621	455
6641, 6651, 6661, 6721	455
6751, 6751A, 6761, 6761A	455
6821, 6861, 6911, 6921	455
6951	455
7000, 7001, 7002	455
7003, 7004, 7005, 7006	455
7007, 7008, 7009, 7010	455
7011	525
7012	175
7013	525
7016, 7017, 7020, 7021, 7022	455
7023, 7024, 7025, 7026	455
7030, 7031, 7032, 7033	455
7034, 7035, 7036, 7037	455
7038, 7039	455
7042	262
7043, 7044, 7045	455
7046, 7047, 7048, 7049	455
7050, 7051, 7053	455
7054	455
7055, 7055A, 7055L	455
7056	455
7057, 7058	455

(Cont'd)

SILVERTONE—*(Cont'd)*

Model	kc
7060, 7060A	265
7061, 7062	175
7063	455
7065, 7066, 7067	455
7068	455
7069	455
7070, 7071, 7072, 7073, 7074	455
7075, 7076, 7077, 7078, 7079	455
7080, 7081, 7082, 7083	455
7083A, 7083B	175
7083C, 7083D	175
7085, 7087	455
7088 (auto radio)	455
7089, 7090	455
7090A	480
7091	455
7092	480
7093	260
7094	455
7099	462
7100, 7101, 7102	455
7103	175
7104, 7106, 7108	455
7109, 7110, 7111	455
7111X, 7112, 7114	455
7115	175
7116	456
7117 (auto radio)	370
7118	480
7119, 7120	465
7123, 7124	456
7125	465
7127	456
7128 (auto radio)	175
7129	480
7132, 7133	456
7134	455
7136, 7137	456
7138	480
7139, 7140, 7141, 7142	456
7143, 7143A, 7144	456
7145, 7146	480
7147	175
7148	480
7149 (auto radio)	175
7150	456
7151	370
7154, 7155	456
7156	175
7157 (auto radio)	456
7158	455
7159	370
7160, 7161, 7162	456
7163 (auto radio)	370
7164	445
7165, 7167, 7168, 7169	455
7170, 7170A	262.5
7171	465
7172, 7172X	456
7175	480
7175A	445
7179, 7180	480
7181, 7182	465
7184	456
7188, 7189	455
7210	465
7214, 7215	456
7216, 7217, 7218	465
7220	456
7221, 7224	465
7225, 7226	456
7227, 7228, 7230	455
7231, 7232, 7233	456
7234, 7235, 7236	456
7237, 7239	465
7241, 7242, 7242A	455
7243, 7244, 7251, 7300	455

(Cont'd over)

SILVERTONE—*(Cont'd)*

Model	kc
7305, 7306, 7307, 7310	455
7312, 7318, 7320, 7322	455
7327	455
7807	465
7900 (Export)	455
7905, 7906, 7910, 7915	455
8714	465
†100.150, 100.150A	262
100.151, 100.151A	456
100.156	456
100.157, 100.158	465
100.159	465
100.179	465
100.184, 100.185	465
100.186, 100.189	465
100.195, 100.196	465
101.407	262
101.408	465
101.410, 101.410A	465
101.411, 101.411A	465
101.411X, 101.411Y	465
101.412, 101.412A	465
101.412B, 101.412X	465
101.414, 101.415	465
101.416	465
101.417, 101.417A	465
101.419, 101.420	465
101.425, 101.425X	465
101.432	465
101.437, 101.438	465
101.442	262
101.443	465
101.445	262
101.447	465
101.448, 101.448A	465
101.449, 101.449A	465
101.450	465
101.451	262
101.453, 101.453A	465
101.453B	465
101.454	262
101.458, 101.458A	262
101.463, 101.463A	262
101.464, 101.465	465
101.471, 101.471A	465
101.471B	465
101.472, 101.472A	465
101.472B, 101.472C	465
101.472X, 101.473	465
101.473A, 101.473B	465
101.474, 101.474A	465
101.474B, 101.474C	465
101.474D, 101.474F	465
101.475, 101.475A	465
101.475B, 101.475C	465
101.475D, 101.475F	465
101.475G	465
101.476, 101.476A	465
101.478, 101.479	465
101.479A, 101.479B	465
101.479C, 101.479D	465
101.479F, 101.479G	465
101.480, 101.480A	465
101.480B, 101.480C	465
101.480D, 101.480F	465
101.480G, 101.480H	465
101.482, 101.482A	465
101.482B, 101.482C	465
101.482D, 101.482F	465
101.482G	465
101.483, 101.483A	465
101.483B, 101.483C	465
101.483D, 101.483F	465
101.483G, 101.483H	465
101.484, 101.484A	465
101.484B, 101.484C	465
101.487, 101.488	465
101.488A, 101.488B	465

(Cont'd)

SILVERTONE—*(Cont'd)*

Model	kc
101.488C, 101.488G	465
101.489, 101.490	465
101.495, 101.495X	262
101.496, 101.496X	262
101.497, 101.498	465
101.499	465
101.502, 101.503	465
101.504	465
101.505, 101.505X	465
101.506, 101.507	465
101.509, 101.510	465
101.511, 101.512	465
101.513	465
101.515	465
101.517	465
101.519	465
101.524, 101.525	465
101.527, 101.528	465
101.532, 101.534	465
101.537	465
103.AR166	456
104.127	456
104.218	456
104.222	456
104.235	456
107.HA6, 107.HA62	465
107.A450, 107.450	465
107.450-2	465
110.7214	456
126.200, 126.201	460
126.202	465
126.203	455
126.204	465

* For all double frequencies refer to identification number of chassis.

† The following numbers, composed of several numerals with a decimal point after the third, are factory identification numbers. These are found at the right rear corner of the chassis. The first three numerals indicate the manufacturer of the chassis (No. 101 indicates that the manufacturer is the Colonial Radio Corp.), the last numerals indicate the *factory* identification number. When ordering parts for these receivers, it is well to specify the complete factory identification number as well as the model number of the receiver.

SIMPLEX
(Simplex Radio Co.)

Model	kc
AA	456
B	175
BT, CA, D	456
D (above 420001)	456
D DeLuxe	456
DA, DB, DB DeLuxe	456
G (above 703001)	456
GB	456
GB (above 779001)	456
GH (above 691001)	456
J	175
JA	456
K, L, N, NDC	175
NT, NTH	456
P(AC)-between serial No. 162500 and 330001	175
P(AC)-above serial No. 330001	456
P(Batt.)	175
P(Batt.)-above serial No. 173501	456
P (DC)	175
P (32-V)	456
P (with '6A7 power tube)	456
P (with '47 power tube)	175
P (1931)	175
Q (auto radio), Q (DC)	175
Q (1931), Q (1937)	175
T (auto radio)	175
TA (auto radio)	456
U (AC-DC), UE, UEX	456
W, W (all-wave)	456
ZS	456
5D, 5DA, 5DB, 5DF	456
6CT, 6GH, 6GM	456
8J, 8JM	456

SKYHAWK

(See Republic Industries)

SKYRIDER

(See Hallicrafters, Inc.)

SOLAR

Model	kc
062	262
062A	262

SONORA

(Sonora Electric Phonograph Co., Inc.)

Model	kc
PR101	456
PR202, PR202C	456
PR300, PR400, PR400C	456
70, 71, 72, 73	262
84, 85, 86, 87	262

SONORA
(Sonora Radio & Television Corp.)

Model	kc
AU-10	456
B-22	456
BE, BJE, BJI, BS	456
C-22	456
D-12, DA-12	456
DD-14, DDA-14	456
E-33, EA-33	456
F-55	456
FA-55, FA-77	456
G-66, GA-66	456
G88	456
GA-88	456
KA-109	456
KB73, KD75	456
KE78, KU9	456
L-22	456
M-22	456
PL	456
PR101, PR202	456
PR300, PR400	456
PS-102	456
Q, QA	456
Q-33, QA-33	456
QA-77	456
R-66, RA-66	456
RA-88	456
SL	456
SM	456
TB, TC, TD	456
TF39, TH46	456
TJ62, TJ63	456
TJF, TL, TM	456
TN45, TNE	456
TNF60, TNF68	456
TR53, TS	456
TSA105, TSA106	456
TT64, TW49	456
TWU49, TX53	456
TX58, TY54	456
TY154	456
70, 71, 72, 73	262
84, 85, 86, 87	262

SPARKS-WITHINGTON CO.
(See listings under Sparton)

SPARTON
(The Sparks-Withington Co.)

Model	kc
D-686, H-686 (auto radios)	172.5
S-676, S-686 (auto radios)	172.5
9X, 10, 12, 13	172.5
14, 14-A	172.5
15, 15-X	172.5
16, *16-AW	172.5
17, 18	172.5
25, 25-X	172.5
26, *26-AW	172.5
27, 27-A, 27-X	172.5
28, 28-X	172.5
30, 30-A, 30-B, 30-C	172.5
33, 33-A, 33-B (auto radios)	172.5
34, 35, 36 (auto radio)	172.5
40, 41A	172.5

(Cont'd)

SPARTON—*(Cont'd)*

Model	kc
43-S, 43-S-1600 (police radio)	172.5
43-S-2400 (police radio)	172.5
44-P, 45, 46-P	172.5
53 (AC-DC)	456
54	172.5
55T	456
56	172.5
57 (AC-DC)	456
58 (country home)	456
60	900
61, 61A, 61B	456
62, 63, 63-AX	456
65, 65-T, 66, 66-T	456
67, 68, 68XS, 70	345
71, 71-B	456
72, 72-PQ	172.5
73, 73-AX, 73-BX	456
74	172.5
75, 75-A, 75-AX, 75-B	456
76	456
77	345
78	172.5
80, 81, 81A	456
82, 83, 84	456
85-X, 85-XS, 86-X	456
104, 105, 105-X, 105-XS	456
111-X	172.5
134, 135, 136	456
333 (auto radio)	456
417-X, 427-X, 437-X, 457-X	456
475-A, 475-AX	456
478	172.5
478-A, 478-AX	456
500BV, 500BW	456
500DG, 500DR, 500W	456
506, 507	456
510BV, 510BW	456
510DG, 510DR, 510W	456
516, 516-X	456
517, 517-B, 517-W, 517-X	456
518, 518X	456
519-X	456
520, 520M	456
527-2, 528-2	456
530X	456
536, 536-X	345
537, 538, 538-X, 538-2	456
539-LX	456
539SX	456
541X	456
546-X, 547-X	456
548X, 549-1, 550M	456
556, 557, 558-B, 558-BX	456
558-C, 558-CX, 558-D	456
559-X	456
566, 567, 568, 568-X	456
570M, 577, 578	456
578-X, 580-X, 587	456
587-2, 588-2	456
590-1	456
594, 608, 608-B	456
609-LX, 609-SX	345
616, 616-M, 616-MX, 616-X	345
617	456
617-X	345
620-M	456
620-X	172.5
628, 628-X	456
636-MX	345
637-6, 638-6	456
640LX, 640SX, 649-6L	456
649-6S, 660M, 655	456
660M	456
666, 666M, 666MX, 666X	345
667	456
667-X	345

(Cont'd)

SPARTON—*(Cont'd)*

Model	kc
668, 668-X	456
670-6L, 670-6S	456
676 (auto radio)	172.5
676-X	345
678, 678-A, 678-X	456
685	345
686 (auto radio)	172.5
686-6, 687-6, 688-6	456
690-M	456
691	345
699	456
716, 716-X, 726-X	456
727, 727-X, 727-XD	456
728X	456
738	456
740LX, 740LX-PA	456
740SX, 740SX-PA	456
748X	456
749-X	345
750-A, 750-X	172.5
760PS	456
766, 766-M, 766-X	456
766-XP, 766-XS, 768, 768-X	456
770, 770PA	456
775 (country home)	345
776, 776-X, 776-XP, 776-XS, 778, 778-X	456
785	172.5
809-SX	456
827-X, 827-XD	456
835, 867	456
870-A, 870-X	172.5
877-X	456
880, 880A	456
928X	456
929-X	456
940LX	456
940SX	456
966, 968, 968-X	456
977, 987, 987-X, 997-X	456
1016-X, 1066	456
1068, 1068X, 1078	456
1078X, 1089	456
1116-X	456
1160	456
1166, 1166-XP, 1166-XS, 1167	456
1176, 1176-XP, 1176-XS	456
1186, 1187	456
1196, 1197	456
1268, 1288P	456
1288LXP	456
1466, 1476	456
1567, 1568, 1867	456
5008, 5018, 5028	456
5218, 5218P, 5518	456
5518A, 5518AX	456
6218	456
7618	456
8618	456

* The short-wave superheterodyne converter in these models operates on an intermediate frequency of 900 kc.

SPIEGEL, INC.
(Air Castle)
(See also Radio Products Corp.)

Model	kc
A-31, AM-3, AM-6	456
AM-7	456
BA-41, B-1	456
H-1	465
H-6	262
L-5, L-6, L-7	456
M-5, M-7, ML-4	456
MX2	456
OC	456
U-6	175
X-1	465
X-6, X-8, Z-2	456
Z-4, Z-5	456
5Y	175
6A	456
6A60	465
6B, 6P, 6Q	456
6T, 6W	456
7AC	456
7D	456
7J	456
8A5	456
9B	456
10M	370
11S, 11X	456
12AC	465
14A	465
16R, 22B, 23	456
23E	456
37B	465
39B	465
40	456
46A	465
58S	465
65B	465
66-660	175
68B	465
72AE	465
75B	465
78-780	175
80B	465
88-880	175
91B	465
98AE	465
100, 102, 104	456
109B	465
112	456
112S	262
114	456
117	480
120	456
127	456
128B	455
129	456
130	456
132	465
134 (46A)	465
134 (L6)	456
140, 142, 144	456
145, 146, 147	456
150	465
152, 154, 160	456
167	456
169	465
172	456
175E	456
178	456
180, 182, 183	456
184	456
186	175
188	465
190	456
202, 211, 212	456
216, 218, 219	456
220, 405, 406	456

(Cont'd)

SPIEGEL, INC.—(Cont'd)

Model	kc
509, 510, 529	456
536, 551, 559	456
562, 600	456
603 (1-6A7)	265
603 (2-6D6	456
613, 629, 630	456
633, 651	456
660	262.5
700	456
701, 725, 745	456
871, 885	456
1002, 1003	465
1008, 1009	456
1010, 1011	456
1052, 1053	465
1060B, 1070B	465
1090B	465
1095B	465
1100, 1101, 1102	465
1103, 1104, 1105	465
1106, 1107, 1108	465
1109, 1110, 1111	465
1150, 1151, 1152	465
1153, 1154, 1155	465
1156, 1157	465
1204, 1205, 1206	465
1207	465
1901, 1902	456
1903	465
1904	456
1906	465
1907	456
1910	465
1911, 1916, 1917	456
1921, 1926, 1932	456
1936, 1952	456
1954	465
1955, 1957, 1959	456
1960	465
1961, 1965, 1971	456
1980, 1981	456
2000, 2001 (6W)	456
2000, 2001 (40)	465
2006, 2007	456
2008, 2009	465
2012, 2013	456
2014, 2015, 2016	456
2018, 2019	465
2050, 2051 (6W)	456
2050, 2051 (40)	465
2056, 2057, 2058	456
2059, 2060, 2061	456
2064, 2065	465
2066, 2067	465
2070, 2071	456
2080, 2081	456
2100, 2101, 2102	465
2104, 2108, 2109	465
2110, 2111, 2112	465
2113, 2120, 2150	465
2151, 2152, 2153	465
2154, 2155	456
2200, 2201, 2202	465
2203, 2204, 2205	465
2206, 2207	465
2212, 2213	456
2214, 2215	456
2220, 2221	465
2222, 2223, 2224	465
2225, 2226, 2227	465
2228, 2229	465
2230, 2231	465
2232, 2233	465
2254, 2255, 2256	456
2257, 2280, 2281	456
2302, 2303	175
4000, 4002	465
4004	456

(Cont'd)

SPIEGEL, INC.—(Cont'd)

Model	kc
4006	465
4010	456
4014	456
4020	465
4040	456
4050	465
4052, 4054, 4056	456
4064, 4066, 4068	456
4070	465
4074, 4076	456
4210, 4212	175
4400, 4402, 4404	456
4410, 4420, 4452	456
4500, 4502, 4503	456
4504	456
4505	465
4506, 4507, 4508	456
4509	456
4510 (1091B)	465
4510 (6246)	465
4512, 4514 (6Q)	456
4514, (9148)	465
4516	465
4519	265
4525, 4530	456
4533	465
4534	370
4536	456
4550	456
4556	465
5004, 5005, 5006	456
5020	465
5052, 5054, 5056	456
5058, 5060, 5062	456
5102, 5104, 5106	465
5110, 5152	465
5200, 5210, 5214	456
5216, 5218, 5256	456
5258	465
5260	456
5300	175
5700	465
6500, 6502	456
6504, (601)	456
6504 (603)	456
6506, 6508, 6510	456
6512, 6514, 6518	456
6520, 6525, 6532	456
6540, 6542, 6544	456
6546, 6550, 6552	456
6554, 6556, 6560	456
6562, 6564, 6566	456
6568, 6570, 6580	456
6582, 6590 (AM7)	456
6590 (633)	456
6600	465
6602, 6606, 6650	456
6700	465
6708, 6712, 6714	456
6716, 6750, 6754	456
6758, 6760, 6766	456
6770, 6772, 6776	456
6800	175
6805, 6806, 6807	262
6808, 6815, 6816	262
6817, 6818	262
6946	465
7700	465
9100	465
9902	465
9904, 9905	456
9907, 9908	465
9910, 9911, 9912	456
9914, 9915	465
9916, 9917	456
9923	465
9926, 9928	456
9932, 9933	465

(Cont'd)

SPIEGEL, INC.—*(Cont'd)*

Model	kc
9936	456
Z5P7026	455
Z5P7112	455

STAR

Model	kc
062, 062A	262
6U	262.5

STAR RAIDER

(See Commonwealth Radio Mfg. Co.)

STEINITE

(Steinite Radio Mf'g. Co.)

Model	kc
20, 22, 26	175
203	175
600, 605, 630, 635	175
642 (all), 642B, 643	175
700, 705, 706, 725	175

STEWART

(Stewart Radio & Telev. Corp.)

Model	kc
50, 60	262

STEWART-WARNER

(Stewart-Warner Radio Corp. See also Firestone Tire & Rubber Co.)

Model	kc
A-6	455
R-104 (Chassis)	177.5
R-104A, B, E (Chassis)	177.5
R-106 Series	177.5
R-111 (Chassis)	456
R-115 (AC-DC) (Chassis)	456
R-116 (Chassis)	456
R-119 (Chassis)	177.5
R-132 (Chassis)	177.5
R-133 (Chassis)	456
R-135 (Chassis)	456
R-141 (Chassis)	456
R-143 (Chassis)	177.5
R-144 (Chassis)	456
R-147-X (Chassis)	456
R-168 (Chassis)	456

(Cont'd)

STEWART-WARNER—*(Cont'd)*

Model	kc
R-170 (Chassis)	456
R-178 (Chassis)	262
01-5D9, 01-5D9-WT	455
01-5H1 to 01-5H9	455
01-6A, 01-6B	455
01-6D, 01-6C9	455
01-6E1 to 01-6E9	455
01-6G1	455
01-6G4-1 to 01-6G4-5	455
01-6G1-Z	455
01-6G4-1Z to 01-6G4-5Z	455
01-6J1	455
01-6K1	455
01-6M9	455
01-8A1 to 01-8A9	455
01-8B1 to 01-8B9	455
01-8C7	455
01-8C7-Z	455
01-9A7	455
01-9A7-Z	455
01-521 to 01-529	465
01-531 to 01-539	465
01-531S to 01-539S	465
01-611 to 01-619	465
01-611S to 01-619S	465
01-811 to 01-819	465
02-4A1 to 02-4A9	455
02-411 to 02-419	465
03-5A1 to 03-5A9	455
03-5B (Senior Varsity)	455
03-5C1	455
03-5E	455
03-5J	455
03-5K1 to 03-5K9	455
03-5R1	455
03-5R3 to 03-5R6	455
03-5S1, 03-5S2	455
03-6J1	455
03-6L7, 03-6L7-2	455
05-5L1 to 05-5L9	455
07-5B Senior Varsity)	455
07-5R1	455
07-5R3 to 07-5R6	455
07-511 to 07-519	465
07-511H to 07-519H	465
07-511S to 07-519S	465
07-551 to 07-559	465
07-631 to 07-639	465
08-521 to 08-529	465
08-811 to 08-819	465
010-521 to 010-529	465
010-531 to 010-539	465
010-531S to 010-539S	465
010-6AX	455
010-6BX	455
010-6CX	455
010-6C9X	455
010-611 to 010-619	465
010-811 to 010-819	465
40 Series	177.5
50-59 (Short Wave I-F)	1525
(Broadcast I-F)	177.5
91-51, 91-53	465
91-61, 91-64	465
91-71, 91-81	465
91-91	465
91-111	465
91-511 to 91-519	465
91-531 to 91-539	465
91-561 to 91-562	465
91-611 to 91-619	465
91-621 to 91-629	465
91-641 to 91-649	465
91-711 to 91-719	465
91-811 to 91-819	465
91-821 to 91-829	465
91-1111 to 91-1119	465
97-52	465

(Cont'd)

STEWART-WARNER—*(Cont'd)*

Model	kc
97-521 to 97-529	465
97-561 to 97-569	465
97-571 to 97-579	465
98-51, 98-53, 98-61	465
98-62, 98-64, 98-71	465
98-81	465
98-111	465
98-511 to 98-519	465
98-531 to 98-539	465
98-611 to 98-619	465
98-621 to 98-629	465
98-641 to 98-649	465
98-711 to 98-719	465
98-811 to 98-819	465
98-821 to 98-829	465
98-1111 to 98-1119	465
102, 102A, B, E	177.5
910-51, 910-53	465
910-61, 910-62	465
910-71, 910-81	465
910-111	465
910-511 to 910-519	465
910-531 to 910-539	465
910-611 to 910-619	465
910-621 to 910-629	465
910-641 to 910-649	465
910-711 to 910-719	465
910-811 to 910-819	465
910-1111 to 910-1119	465
1090-1099	177.5
1091-1099	177.5
1101 to 1109	177.5
1111 to 1119	456
1121, 1122, 1123	456
1151 to 1159	456
1161 to 1169	456
1171, 1172	177.5
1181, 1182	177.5
1191 to 1199	177.5
1201 to 1209	
(Short Wave I-F)	1540
(Broadcast I-F)	177.5
1231 to 1239	456
1251 to 1259	456
1261 to 1269	456
1271 to 1279	456
1281 to 1289 (Batt.)	456
1281-D to 1289-D	456
1301 to 1309	456
1311 to 1319	177.5
1322	177.5
1332	456
1341 to 1349	456
1351 to 1359	456
1361 to 1369	456
1371 to 1379	456
1381 to 1389	456
1391-1399 (Batt.)	456
1391-D to 1399-D	456
1401 to 1409	456
1411 to 1419	456
1421 to 1429	456
1431	177.5
1441 to 1449	456
1451 to 1459	456
1461 to 1469	456
1471 to 1479	456
1481 to 1489	456
1491 to 1499	456
1601 to 1609	177.5
1611 to 1619 (Batt.)	456
1611-D to 1619-D	456
1621 to 1629 (Batt.)	456
1621-D to 1629-D	456
1631 to 1639 (Batt.)	456
1631-D to 1639-D	456
1641 to 1649 (Batt.)	456
1641-D to 1649-D	456

(Cont'd over)

STEWART-WARNER—*(Cont'd)*

Model	kc
1671 to 1689	456
1691 to 1695	262
1701 to 1709	456
1701-X to 1709-X	456
1711 to 1719	465
1711 to 1719 (AC-DC)	465
1721 to 1729	262
1731 to 1739	456
1751 to 1759	456
1751-X to 1759-X	456
1781	262
1801 to 1809	465
1811 to 1819	465
1821 to 1829	465
1831 to 1839	465
1833 to 1835	465
1841 to 1849	465
1845 to 1855	465
1851 to 1859	465
1861 to 1869	465
1871	262
1881 to 1889	465
1901 to 1909	465
1911 to 1919	465
1921 to 1929	465
1931 to 1939	465
3041 to 3049	465
3091 to 3099	465

STROMBERG-CARLSON
(Stromberg-Carlson Telephone Mf'g. Co.)

Model	kc
Compact Police	175
19, 20, 20-AC, 21	175
22, 22-A	175
24, 25, 26, 26-AC	175
27, 27-AC, 29	175
31	175
31X (Police)	175
33, 33A (auto radio)	260
37, 38, 39, 40, 41	175
47, 48, 49, 50, 51, 52	175
54, 55, 56, 56-R, 57	175
58, 58-I, 58L, 58LB	465
58-T, 58TB	465
58-W, 58WB	465
60, 60-H, 60-H (DC), 60-HC	370
60-L, 60-L (DC), 60-LC, 60-LL, 60-LLC	370
60-PR, 60-T, 60-T (DC), 60-TC	370
61, 61-H, 61-HC	465
61-L, 61-LC, 61-LZ	465
61-N, 61-NC	465
61-T, 61-TC	465
61-U, 61-UC	465
61-W, 61-WC, 61-Y	465
62, 62B, 62-C	465
63, 63B, 63-C	465
64	260
65	260
65A	260
66, 67	260

(Cont'd)

STROMBERG-CARLSON —*(Cont'd)*

Model	kc
68, 68-A, 68-F	370
68-H, 68-R, 68-RF	370
69	545
70, 70B	260 or 370*
72, 72B, 72D	260 or 370*
74, 74B, 74D	260 or 370*
80, 82, 82B, 83	465
83B, 83C, 84, 84B	465
115, 125 (AC-DC), 125-H	465
126 (AC-DC), 126-H, 126-L, 126-P	465
127 (AC-DC), 127H	465
127-R, 129	465
130, 130-H, 130-J, 130-L	465
130-M, 130-R, 130-U	465
140, 140-H, 140-K	465
140-L, 140-M, 140-P	465
145, 145-L, 145-P, 145-SP	465
150, 150L, 150LB	465
160, 160-L, 160-P	465
180, 180L, 180LB	465
213F, 225, 225-AC-DC	465
225H	465
228, 228H, 228L, 229P	465
230, 230H, 230L	465
231, 231F, 231P, 231R	465
235, 235H, 235-HB	465
235L, 235-LB	465
240, 240H, 240L, 240M	465
240P, 240R, 240S, 240W	465
245, 245L, 245LB, 245M, 245MB, 245P, 245PB, 245R, 245RB	465
250, 250L, 255, 255L	465
260, 260L, 260P	465
320, 320H, 320HB	455
320T, 320TB	455
325J, 325JB	455
325N, 325S, 325SB	455
335, 335L, 335LB	455
336, 336P, 336PB	455
337H, 337HB, 337L	455
337LB	455
340F, 340FB, 340H	455
340HB	455
340M, 340MB, 340P	455
340PB, 340V, 340VB	455
341P, 341PB, 341R	455
341RB	455
345F, 345FB, 345M	455
345MB	455
350M, 350MB, 350P	455
350PB	455
350R, 350RB, 350V	455
350VB	455
360M, 360MB, 370M	455
370MB	455
400H, 400HB, 400N	455
400NB, 400S, 400SB	455
402, 405H, 410H	455
410HB, 410J, 410JB	455
410T, 410TB, 411PF	455
411PFB, 411PT, 411PTB	455
412H, 412HB, 420H	455
420HB, 420L, 420LB	455
420PL, 420PLB, 420PR	455
420PRB	455
425H, 425HB	2100
430H, 430HB, 430L	455
430LB, 430M, 430MB	455
430PL, 430PLB, 430PF	455
430PFB	455
435 (Amp. Mod.)	455
(Freq. Mod.)	2100
440M, 440MB, 450M	455
450MB	455
455M (Amp. Mod.)	455
(Freq. Mod.)	2100

(Cont'd)

STROMBERG-CARLSON —*(Cont'd)*

Model	kc
455MB (Amp. Mod.)	455
(Freq. Mod.)	2100
455PL (Amp. Mod.)	455
(Freq. Mod.)	2100
455PLR (Amp. Mod.)	455
(Freq. Mod.)	2100
460PF, 470PF	455
480M (Amp. Mod.)	455
(Freq. Mod.)	3000
480MB (Amp. Mod.)	455
(Freq. Mod.)	3000
500H, 500J, 500S	455
509PF, 509PFB, 509PT	455
509PTB	455
520H, 520HB, 520J	455
520JB, 520L, 520LB	455
520PF, 520PFB, 520PG	455
520PGB, 520PL, 520PLB	455
530PL, 530PLB	
(Amp. Mod.)	455
(Freq. Mod.)	4300
535M, 535MB (Amp. Mod.)	455
(Freq. Mod.)	4300
535PG, 535PGB	
(Amp. Mod.)	455
(Freq. Mod.)	4300
535PL, 535PLB	
(Amp. Mod.)	455
(Freq. Mod.)	4300
535PS, 535PSB	
(Amp. Mod.)	455
(Freq. Mod.)	4300
555	
(Freq. Mod.)	4300
600	455
925H, 925HB, 925L, 925LB, 925PF, 925PFM, 925PFB, 925PS, 925PSY, 925PSB, 935M, 935PF, 935PL, 935PR	
(Amp. Mod.)	435
(Freq. Mod.)	4300

* Proper i-f value stamped on chassis.

STUDEBAKER-Philco Receivers
(Studebaker Corp.)

(Also see **Studebaker Models** listed under **Philco Radio & Television Corp.**)

Model	kc
AC-206	260
AC236, AC266	260
S-1416	260
S-1431, S-1437	260
S-1516, S-1526	260
SCD, SJD, SQD	260
ST3, ST7	260
ST12, ST15	260
10C	260

SUPER-PRO
(See **Hammarlund**)

SUPERTONE
(Supertone Products Corp.)

Model	kc
Superba	465
A31	456
L5, L6, L7	456
Z4, Z5	456

SYNCHROPHASE
(See Grebe)

SYNCRATONE
(See Gaylord)

L'TATRO
(See L'Tatro listing in letter "L" section)

TOM THUMB
(See Automatic Radio Mfg. Co., Inc.)

TIFFANY TONE
(Herbert H. Horn Mfg. Co.)

Model	kc
Riviera 66, 66MT, 66PR	465
5, 5A, 5AB, 5AC, 5AD	465
5AVC, 5AW	465
5M, 5MB	465
5MT, 5MTC, 5MTD	465
5MTW, 5MW, 6C	465
7C, 7MT, 7MTC	465
8M, 8MT, 8MTC	465
9M	1600
9MT, 9MTC	1600
10MT, 10MTC	1600
11-A	465
16MT	1600
17MT	1600
16MTC, 17MTC	1600
24	465
30, 32	175
36	465
50, 50-B, 50-I, 50-P, 50-PR, 50-R	465
51, 51C	465
52, 52C, 55	465
56	465
57, 58	465
59	175
62, 62C	465
63	465
65, 65C	465
66, 66C	465
66MT, 66MTC, 66PR, 67, 67A, 67C	465
69	465
70, 71	175
72, 73, 73C, 73PR	465
76	465
76MT, 77	465
79	175
83, 83C, 83W, 87	465
87A, 87B, 87C, 87WE	465
90	175
97, 97C	465
99, 101, 101-B	175
102, 102B, 109	175
110, 111	175
112-A, 124	465

(Cont'd)

TIFFANY TONE—*(Cont'd)*

Model	kc
136	465
156, 156AW, 156-C	465
158, 158-C	465
419	465
501	465
517, 517PR, 517WE	465
518, 518A, 518APR	465
518C, 518CA	465
518PR, 518WE	465
535, 536 (auto radios)	465
537, 538 (auto radios)	465
557 (auto radio)	465
611, 612	465
639, 710	465
935, 936	456
1934	175

TINY TIM
(See Dunn-Hall)

TOBE
(Tobe Deutschmann Corp.)

Model	kc
Communication G	456
Communication M	456
PCA Converter AW	550

TRANSFORMER CORPORATION OF AMERICA
(Clarion, TCA)

Model	kc
AC-80, AC-81, AC-84	175
AC-85, 85 (25 cycles)	175
AC-90, AC-90A, 90 (25 cycles)	175
AC-91, 91 (25 cycles)	175
AC-94, 94 (25 cycles)	175
AC-100	175
AR-100	465
AC-140, 140 (25 cycles)	175
AC-160, 160 (25 cycles)	175
AC-220, 220 (25 cycles)	175
AC-240, 240 (25 cycles)	490
AC-260, 260 (25 cycles)	175
AC-280, 280 (25 cycles)	175
AC-300, AC-320, AC-340	175
TC-1, TC-2	262
TC-6	465
TC-15	175
TC-20	465
TC-21	465
TC-22, TC-23	456
TC-28, TC-29	465
TC-31	456
TC-35A	456
TC-35LW	456
TC-36	456
TC-36A	456
TC-36LW	456
TC-37	456
TC-37A	456

(Cont'd)

TRANSFORMER CORPORATION OF AMERICA—*(Cont'd)*

Model	kc
TC-37LW	456
TC-38	456
TC-39	456
TC-39A	456
TC-39LW	456
TC-42	456
TC-43	456
TC-44	456
TC-50	175
TC-53A	456
TC-65	456
TC-66	456
TC-75	456
TC-76	456
25-94	175
25-160	175
25-280	175
83	175
92, 95, 96	175
100 (25 cycles), 101	175
110, 111	175
120, 120-139	175
121	175
130, 131, 139	175
150	175
170, 171	175
200	1000
230, 241	175
270, 290	175
321, 322	175
360	175
400, 401, 407	456
420	175
422, 423, 425, 440	465
450, 451	465
470, 471	465
472, 480	465
490, 500	175
506	456
600, 601	456
700, 701	456
750, 751	456

TRANSITONE
(See Philco)

TRAV-LER
(Trav-ler Radio & Telev. Corp.)

Model	kc
5 Tube Batt.	456
6 Tube Auto	262
6 Tube Batt. or AC	456
7 Tube Auto	262
7 Tube AC-DC	456
8 Tube Batt.	456
11 Tube AC Super	456
A-549	456
S-8, S-9, S-10	175
8	456
32	456
51, 53, 54	456
54A (auto radio)	456
60A, 63A, 63M	456
64 (auto radio)	456
76	456

(Cont'd over)

TRAV-LER—(Cont'd)

Model	kc
112, 115	456
131, 131 (Late)	456
135M, 136, 137, 138	456
149M	456
163, 173, 179, 250	456
315, 315SW, 325	456
336, 415, 425, 425M	456
426, 426M, 431	456
431SW, 436M, 437M	456
455 ,455L, 455LN	456
465, 465M, 466	456
466M, 500, 505	456
511, 511A, 512	456
522, 525, 526, 527	456
530, 536M, 536MC	456
538M, 538MC	456
539M	456
539M (Late)	456
542 (auto radio)	456
549, 550	456
551B	456
552B	456
553, 553B, 553BT	456
554, 554BT	456
555, 555BT	456
556, 556B	456
556BT, 560B, 570B	456
570BC, 575B	456
576, 576B, 590	456
600	456
601 (auto radio)	262.5
610 (auto radio)	456
616	456
620, 621, 622, 623	456
626, 627, 630	456
633, 634, 635	456
635M, 636, 636M	456
642 (auto radio)	456
645, 645E, 650	456
660 (auto radio)	262.5
679, 680, 701	456
710, 711 (auto radio)	456
716, 720, 730, 733	456
770 (auto radio)	262.5
801, 830	456
1555, 1555BT	456
1556, 1556B, 1556BT	456
5270, 6300	456

TREBOR
(Trebor Radio Co.)

Model	kc
T53, T54	455
T60	455
T81, T85	455

TRIANGLE ELECTRIC CO.
(Imperial)

Model	kc
6P, Imperial	465

TROPIC-AIRE

Model	kc
06W	262

TROY
(Troy Radio & Telev. Co.)

Model	kc
C-170-PC	465
M51, M61	465
M72AC-DC	465
M516	465
M626	465
P51	465
P626	465
X72	465
TR5A, TR50, TR51B	465
TR53, TR-53CH, TR-55	465
TR57, TR57PC, TR57SW	465
TR63, TR63B	465
TR66, TR67, TR67SW	465
TR-68 (auto radio)	465
TR74B, TR75CH, TR75PC	465
TR77, TR79, TR84, TR86	465
TR95, TR100, TR151	465
TR-153 (AC-DC)	465
TR-163, TR-179, TR-184	465
TR711	465
4, 5L5, 5U5	465
15, 15-5	465
40, 42, 45, 45M, 46	465
51B5	465
52, 53CH	465
54	465
55, 55CC	465
56	175
57, 57B, 57PC, 57PC-CC	465
58, 58PC, 59PC	465
62BC, 62BU, 62C	465
62-L, 62PC, 62U	465
65, 67, 67-SW	465
68 (auto radio), 69B	465
74, 74B	465
75, 75B, 75C, 75CH, 75PC	465
77, 77C, 79	465
79-6110	465
79PC	465
82C, 84, 84-C, 84PC, 84U	465
85	465
86, 87 (auto radios), 95, 95PC, 100	465
113	465
151-5, 153, 157PC	465
162, 162C, 162U	465
170	465
C170	465
175, 179	465
557	460
825	465

TRUETONE
(Western Auto Supply Co.)

Model	kc
D689 (Series 9A14)	456
D690 (Series 192)	456
D691	456
D692 (Series 155)	385
D692 (Series 164)	456

(Cont'd)

TRUETONE—(Cont'd)

Model	kc
D694, D695	456
D697, D698	456
D699 (Series 147E)	456
D699 (Series 840)	465
D707	456
D700, D701	456
D702, D703	456
D704 (Series U62C)	470
D705 (Series A12)	456
D705WG (Series A12)	456
D706	465
D707	456
D708	456
D709	175
D709 (Series 6D)	456
D710, D711	456
D711-D930 (Series 209)	456
D712 (D. R. C.)	456
D712 (Series 193)	456
D712M	456
D713 (Series 6B)	456
D714	465
D714M	456
D715 (D. R. T.)	456
D715 (Series 205)	456
D716 (Series 7A)	456
D717	465
D718, D719, D720	456
D721 (Series 206)	456
D722	456
D723	465
D724, D725, D726	456
D727, D728	456
D731 (Series 606)	470
D731 (1935)	465
D731-5	470
D732, D734 (auto radio)	465
D735, D736	175
D737, D737C, D739	175
D740	175
D741, D742	175
D743 (Series 661) (auto radio)	465
D743 (Series 1312)	177.5
D744 (1936)	465
D744 (auto radio)	262.5
D745 (auto radio)	175
D746 (Series 577) (auto radio)	465
D747 (Series 677) (auto radio)	465
D900 (Series 215)	456
D901 (Series 210)	456
D910, D920	465
D920 (Series B)	465
D921, D929	465
D930	456
D941, D976	465
D978, D1001	465
D1040, DE3000	465
O6W	262
OF	456
S709 (1935)	175
S710, S712	456
S716, S717	175
S719	262
S720, S721	175
S721 (1936)	456
S725, S726, S727	456
S740	175
S743	177.5
5Z	456
6D	175
6F, 6G	456
6L	175
6P	456
6R, 6S	175
6U	262.5

(Cont'd)

TRUETONE—*(Cont'd)*

Model	kc
6Y, 7E, 7GM	456
7P, 7Q, 7RL, 9C	456
670	175
686M	465
1312	177.5

ULTRAMAR
(Ultramar Mfg. Corp.)

Model	kc
A-889	456
T-85	456
T-90	456
43, 44	456
51, 52	480
54, 55	480
61, 62	480
65-A, 66-A	480
71, 72	480
75, 76	480
96, 101	480
159	465
306, 307, 309	465
316, 317, 319	465
325, 327	465
335, 337	465
345, 355	465
366, 376	465
378, 385, 386	465
387, 389, 395	465
396, 397, 398	465
455, 456	456
465, 475	456
477, 485	456
487, 487E	456
510, 520	465
525, 526	456
601, 602, 612 (auto radio)	456
655	456
701, 702	465
711, 712	465
733	456
801, 802	465
826, 846	465
838, 839	465
856, 857	465
866, 867	465
877, 889	456
910	465
1004, 1005	480
1005-A, 1006	480
1006-A, 1007	480
1008, 1009	480
1010, 1011	480
1014, 1017	480
1018, 1019	480
1025, 1026	480
1028, 1029	480
1035, 1036	480
1039, 1046	480
1056, 1066	480

UNITED AIR CLEANER CORP.
(See Sentinel Radio Corp.)

UNITED AMERICAN BOSCH CORP.
(See listings under Bosch)

UNITED MOTORS SERVICE
(Auburn, Buick, Chevrolet, Cord, Delco, Graham-Paige, Oldsmobile, Pontiac)

Model	kc
Air Chief 544268 (above No. 1,791,090)	262
Air Chief 544290-91 (above No. 300,000)	172
Air Chief 544290-91 (above No. 500,000)	262
Air Mate 544267 (above No. 1,791,090)	262
Air Mate 544289 (above No. 300,000)	172
Air Mate 544289 (above No. 1,791,090)	262
Chevrolet (auto radio)	262
De Luxe 983506	262
Master 983507	262
Oldsmobile (auto radio)	262
1935 Auto Radio (Chevrolet)	262
A3	175
A5A3 (Auburn)	181.5
A255 (Cord)	450
A355 (Graham-Paige)	450
A455 (Cord)	450
A555 (Graham-Paige)	450
ATP-101, ATP-102 (Graham-Paige), B3	175
R-640, R-641 (Delco) (auto radios)	262
R-642, R-643, R-644 (Delco), R663 (auto radios)	262
R-664, R-665 (auto radios)	262
R-666, R-667 (auto radios)	262
R-668, R-669 (auto radios)	262
R-673 (Delco)	262.5
R-1115 (below 100,000) (Delco)	465
(above 100,000) (Delco)	456
R-1116, R-1117 (Delco)	456
R-1118, R-1119 (Delco)	456
R-1120 (home radio), R-1125 (Delco)	465
R-1126, R-1127, R-1128 (Delco)	465
R-1129, R-1130 (Delco)	465
R-1131, R-1132 (Delco)	465
R-1134, R-1135 (Delco)	465
R-1139, R-1140 (Delco)	465
R-1141, R-1142 (Delco)	465
R-1143, R-1144 (Delco)	465
R-1145, R-1150	465
R-1151, R-1152	465
R-1153, R-1154	465
R-1155, R-1156	465
R-1157, R-1160	465
R-1400, R-1401	465
R-1402	465
R-2050, R-2055 (Delco)	465
R-3205, R-3208, R-3209 (Delco)	450
R-3210, R-3212 (Delco)	465
R-3215 (Delco)	455

(Cont'd)

UNITED MOTORS SERVICE —*(Cont'd)*

Model	kc
R-6011, R-6012 (Delco) (home radios)	465
R-6015 (Delco)	465
RB-1, RC-1 (Delco)	175
66	175
626, 627, 628 (Delco)	262
629 (below 40,100) (Delco)	450
(above 40,100) (Delco)	262
630, 631 (auto radio), 631A (Delco)	262
632, 633, 634, 635 (Delco) (auto radios)	262
663, 664, 665 (auto radios)	262
666, 667 (auto radios)	262
668, 669 (auto radios)	262
1101 (Delco)	181.5
1102, 1103 (Delco)	456
1104 (Delco)	456
1105 (Delco)	450
1106 (Delco)	465
1107 (Delco)	450
1108 (Delco)	490
1109, 1110 (Delco)	455
*1115 (Delco)	465
*1116, *1117 (Delco)	456
*1118, *1119 (Delco)	456
2035 (Delco)	262
*2050 (Delco)	465
3026 (Delco)	175
3201, 3202 (below 800,000) (Delco)	262.5
3201, 3202 (above 800,000) (Delco)	456
3203, 3204 (Delco)	456
*3205, 3206 (Delco)	450
3207 (Delco)	450
*3208, *3209 (Delco)	450
4036, 4037, 4038 (Delco)	262
4048 (Delco)	455
4049, 4050, 4051 (Delco)	181.5
4052 (Delco)	456
4053, 4053A (Delco)	181.5
4054 (Delco)	262
6010 (Delco)	465
364441 (Chevrolet)	262
393884, 393885 (Oldsmobile)	262
405045, 405046 (Oldsmobile)	262
405057 (Oldsmobile)	172
405062, 405063 (Oldsmobile)	172
544245 (Buick-Pontiac)	262
544246 (Pontiac)	262
544267, 544268	262
544289 (Pontiac)	262
544290, 544291 (Olds. & Pontiac)	262
544297, 544298 (Pontiac)	172
600153, 600249 (Chevrolet)	262
600565, 600566 (Chevrolet)	262
601038 (Chevrolet)	175
601176, 601177 (Chevrolet)	262
601525	262
601574 (Chevrolet)	175
601586	262
601662 (Chevrolet)	262
601814 (Chevrolet)	262
980393 (B.O.P.)	262
980455, 980459 (B.O.P.)	262
980507, 980508 (Buick)	262
980509 (Buick)	262
980525, 980526 (Buick)	262
980529	262
980534, 980535 (Buick)	262

(Cont'd over)

UNITED MOTORS SERVICE —(Cont'd)

Model	kc
980566 (1304873) (Buick)	260
982006, 982007 (Oldsmobile)	262
982008 (Oldsmobile)	262
982043, 982044 (Oldsmobile)	262
982045 (Oldsmobile)	262
982083 (Oldsmobile)	262
982084 (Oldsmobile)	262
982085 (Oldsmobile)	262
982127	455
982153	262
982160	260
982161	260
983506, 983507 (Pontiac)	262
983526 (Pontiac)	262
983527 (Pontiac)	262
983534 (Pontiac)	262
983569 (Pontiac)	262
983570 (7232553) (Pontiac)	262
985100	262
985200	262.5
985252 (Chevrolet)	262
985253 (Chevrolet)	262
985254 (Chevrolet)	262
985255 (Chevrolet)	262.5
985283 (Chevrolet)	262.5
985284 (Chevrolet)	262
985285 (Chevrolet)	262
985300, 985301 (Chevrolet)	262
985400	262
985424	262.5
985426	262.5
1291344, 1291345 (Buick)	262
1304873 (980566)	262
7232553	262

* See also the corresponding listings under letter "R" models, such as R-1115, R-1116, etc.

UNITED SCIENTIFIC LABS.
(See De Wald)

UNIVERSAL
(Universal Battery Co.)

Model	kc
Midget	455
26B3, 26B7	175
50A6	465
52T, 56T	456
60 (auto radio)	262
61A6, 63A6	465
66T	456
70 (auto radio)	262
72A6, 73A6, 74A6	465
80 (auto radio)	262
600T, 610T	456
613V	465
629	456
802	456

(Cont'd)

UNIVERSAL—(Cont'd)

Model	kc
803	447.5
804, 805 (auto radios)	465
806, 807 (auto radios)	465
810C, 810T	456
1210C	456
1510C	456
5010	465
5032 (1935)	456
5032 (1936)	465
6110, 6132	465
6310, 6332	465
7232, 7332	465
8210, 8232	465
8410, 8432	465

U. S. RADIO & TELEVISION CORP.
(Apex, U. S. Radio & Television)

Model	kc
5-A	455
7, 7-A	262
7	455
8 Series	262
9, 9A, 9B	262
10, 10-C, 12, 12-B	262
19, 19B	262
24, 25, 25A	455
69, 96	262
99 Series	262
112-A	1000
120, 120B	262
400, 500, 502	455
507, 513, 700	455
900, 902, 906	262
1000, 1001	262
1006, 1007	262
1107, 1200	262
3014	262
3040, 3056	455
3070	262
3084, 3086	455
3084, 3086 (Serial No. 1344156 to 1344652)	427
3084, 3086 (Serial No. 1345799 to 1395800)	427
3092	455

UTAH PRODUCTS CO.

Model	kc
400A Series	180
400B	180

VICTOR
(See RCA Victor)

VICTORY
(See Champion Radio Labs.)

VIKING
(See Ozarka)

WALGREEN CO.
(Aetna)

Model	kc
B25RS	456
B66R1S	456
M8	456
22U-73	465
32B, 34B	465
55RS, 57RS	456
66 AC-DC	456
166R1S	456
300, 300P, 308	465
360, 370	456
400	175
409, 419	456
500	370
502	456
510, 525, 529	456
550AC	456
550 (auto radio)	456
575	175
585 Series A	370
600, 630	456
635, 650	456
651	465
652	456
675	370
700	456
750	465
800, 901	456
1050	175

WARE

Model	kc
S-1	175
SB1, SB7, SB8, SB45	175
SBA, SBB	175
SBF, SBFA	175
SB-45	175

WARWICK
(Warwick Mf'g. Co.)

Model	kc
5 Tube (auto radio)	456
5 & 6 Tube (AC Super)	456
6 Tube (auto radio)	262.5
7 Tube Batt.	456
0-40, 0-50, 0-51	455
0-53, 0-60	455
0-63 to 0-83 incl.	455
0-300 to 0-309 incl.	455
0-407	455
0-430 to 0-449 incl.	455
0-501	455
0-610 to 0-629 incl.	455
9-41	455
9-42	455
9-43	455
9-44	455
9-45	455

(Cont'd

WARWICK—*(Cont'd)*

Model	kc
9-53	455
9-58	455
9-59 (auto radio)	455
9-61	455
9-63	455
9-64	455
9-66	455
9-480 to 9-489 incl.	455
9-550 to 9-559 incl.	455
9-627	455
9-670 to 9-689 incl.	455
10-70	455
400	456
406	455
453, 501, 510C	456
511, 517, 518	456
521, 525, 530	456
536, 540, 550	456
550C, 551, 553	456
559, 560	456
579	456
592 (auto radio)	456
600, 601, 604	456
606, 610	456
611 (auto radio)	175
613	456
618	175
621, 629	456
630, 631	455
633, 635	456
646 (auto radio)	262
648, 648D	455
651	456
652B	455
653	456
654	456
655B	455
659	262
660	262.5
665	175
668, 668B	455
683	456
686	262.5
700, 701, 725	456
741	456
746	262
749, 751, 761	456
768, 768B	455
780	456
846	262
871, 872	456

WATTERSON
(Watterson Radio Mf'g. Co.)

Model	kc
L440	455
6B, 6BC	456
49	455
49C	456
55, 55C	175
56, 56C	456
57, 57C	456
58, 60B, 60BC	456
66B, 67, 67C	456
68, 68C	456
69	456
78, 78C	456
79	456
85, 86	456
95, 95C	456

(Cont'd)

WATTERSON—*(Cont'd)*

Model	kc
336, 336C	456
600, 630, 650	456
806	456

WELLS-GARDNER
(Wells-Gardner & Co.)
(Arcadia)
(Truetone, Wells-Gardner. Also see Gulbransen Radio Co.)

Model	kc
A1, A2	456
A3, A4, A5, A6	456
A7, A8, A9, A10	456
A11, A12, A13	456
A14, A15	456
A16, A17	456
A-20, A-22, A-23, A-24	456
B-1, B-2, B-3, B-4	456
C2, C3, C4, C5	175
C6 (auto radio)	456
C7 (auto radio)	175
C-11	175
OC	456
ODM	456
OEL	456
OF, OFLB	456
OGL	456
OOA, OOB	175
S1, S2	456
T-1, T-2, T-3	456
V6Z2	262
02A, 02AA	175
05A, 05AA	262
05B, 05BA, 05C	262
06A	175
06W, 06X, 06Z (Z6Z1)	262
07A, 07B	175
022	175
052, 062 (auto radio)	262
062A, 072, 072A	262
073	175
092	175
1A-17	456
1A-29	456
2B, 2CM, 2DL	456
3A	456
4B-5 Series	456
4C	456
5A-25S	456
5B	262
5C	262
5C-10 Series	456
5D	456
5D-2	456
5E	175
5F, 5FL	456
5G, 5X	175
5H, 5K, 5KL	456
5U, 5Y	175
6A-26, 6A-26S	456
6A-27	456
6A-43 Series	456
6A-44 Series	456
6B	175
6B-7 Series	456
6B-10	456
6C	456
6C1 (auto radio)	175
6CH-5	175
6C13 (auto radio)	456
6D	175
6D-1	456

(Cont'd)

WELLS-GARDNER—*(Cont'd)*

Model	kc
6EL, 6F, 6G	456
6J, 6K, 6KB, 6L, 6N (auto radios)	175
6P (auto radio)	175
6Q, 6R (auto radio)	175
6S (auto radio)	175
6T, 6U (auto radios)	262.5
6V	262.5
6-Z-1	262
7A-41	456
7C	175
7C-15	456
7-D, 7-E	456
7FL	456
7GM	456
7H, 7J, 7K	456
7L, 7LL	456
7P, 7Q, 7QL	456
7R, 7RL	456
8A-30, A-31	456
9A-46 Series	456
9B, 9C	456
10, 13	175
17X	125
20	175
22B-5	456
26B-1	175
26B-5	175
27C-1	175
27C-5	175
35G-510	175
35G-560	175
37G-508	456
37G-566	456
37H-508	456
37H-566	456
40, 40-A	175
50	175
90, 91, 92, 93	175
322	175
352	262
502	175
572	175

WESTARK RADIO CORP.
(See Allied Radio and "Knight")

WESTERN AIR PATROL

Model	kc
W221	262.5
W403	467.5
W409	175
W416	456
W491	462
W493	455
W931	456

WESTERN AUTO SUPPLY CO.
(See listings under Truetone)

WESTINGHOUSE ELECTRIC INTERNATIONAL CO.* (Export Models)

Model	kc
WR-5, WR-6, WR-6R	175
WR-7, WR-7R	175
WR-8, WR-8R	175
WR-10, WR-10A	175
WR-12, WR-12A	175
WR-13, WR-13A	175
WR-15, WR-15A	175
WR-16, WR-17	175
WR-18	175
WR-19, WR-20	175
WR-21, WR-22	175
WR-23, WR-24, WR-25	175
WR-27, WR-28, WR-29	175
WR-30, WR-31	445
WR-32	460
WR-32A	460
WR-33	175
WR-34, WR-35, WR-36	175
WR-37	370
WR-38, WR-39	445
WR-41, WR-42	175
WR-45	460
WR-45A	460
WR-46, WR-46A, WR-47	460
WR-48, WR-48A	460
WR-49, WR-50	460
WR-53	460
WR-100, WR-101	456
WR-102, WR-102A	465
WR-103, WR-103A	465
WR-116, WR-116X	465
WR-120	455
WR-200, WR-201, WR-203	456
WR-204, WR-205, WR-206	465
WR-207, WR-208	456
WR-209, WR-209X	465
WR-210, WR-211	465
WR-211A, WR-211U	465
WR-211X	465
WR-212, WR-212X	465
WR-214, WR-218	465
WR-222, WR-223	455
WR-224, WR-226	455
WR-227, WR-228	455
WR-229	455
WR-230, WR-231	455
WR-303	456
WR-304, WR-305	465
WR-306, WR-310	465
WR-311, WR-311X	465
WR-312, WR-312X	465
WR-314	465
WR-315	465 and 100
WR-316, WR-316X	465
WR-330, WR-331	455
WR-332, WR-334	455
WR-336, WR-338	455
WR-500, WR-501	175
WR-502, WR-503	175
WR-600	463
WR-603, WR-604	465
WR-605, WR-606	465
WR-607, WR-608	465
WR-609	455
WRJ models (all)	455

* Sold only in Export markets, excluding Canada. Some of these models are identical to those of Westinghouse Electrical Supply Co., but many of them have no similarity even though they may have similar model numbers.

WESTINGHOUSE *(AMERICAN)* (Westinghouse Electric Supply Co.)

Model	kc
WR-5, WR-6, WR-6-R	175
WR-7, WR-7-R	175
WR-8, WR-8-R	175
WR-10, WR-10A, WR-10-DC	175
WR-12, WR-12DC	175
WR-13, WR-13A	175
WR-15, WR-15A	175
WR-16, WR-17	175
WR-18, WR-18 (DC), WR-19	175
WR-21, WR-22	456
WR-23, WR-24	456
WR-25 (auto radio)	172.5
WR-26 (auto radio), WR-26M	175
WR-27, WR-28, WR-29, WR-30	456
WR-100	456
WR-101-U6A	456
WR-101-U6F	456
WR-102, WR-102A	465
WR-103, WR-103A	465
WR-116	465
WR-120, WR-140	455
WR-150	456
WR-150I, WR-150W	456
WR-152, WR-154	455
WR-158, WR-161I	455
WR-162, WR-165M	455
WR-165W	455
WR-166 Series	455
WR-168, WR-168A	455
WR-169, WR-170	455
WR-201, WR-203	456
WR-204, WR-205	465
WR-207, WR-208	456
WR-209, WR-210	465
WR-211, WR-212, WR-214	465
WR-217	456
WR-222, WR-224	455
WR-226, WR-228	455
WR-256, WR-258	455
WR-260, WR-262, WR-264	455
WR-270	455
WR-303	456
WR-304, WR-305, WR-306	465
WR-310, WR-311	465
WR-312, WR-314	465
WR-315	465 and 100
WR-316	465
WR-326, WR-328, WR-330	455
WR-332	455
WR-334, WR-336	465
WR-338, WR-342	455
WR-366, WR-368, WR-370	455
WR-468, WR-468L	455
WR-472	455
WR-475	455
WR-500 (auto radio)	175
WR-501 (auto radio)	172.5
WR-502 (auto radio)	175
WR-503 (auto radio)	175
WR-601, WR-602	456
WR-603, WR-604	465
WR-605, WR-606	465
WR-607, WR-608	465
WR-610	455
WR-675, WR-675A	455
WR-677	455

WESTINGHOUSE *(CANADIAN)* (Canadian Westinghouse Co., Ltd.)

Model	kc
Columaire	178
A-43, A-44	175
B-63, B-64	370
B-74	460
B-83, B-103	175
B-428A	460
B-440A	460
B-460A	460
B-461A	460
B-517A, B-517X	460
B-541, B-541A, B-541X	460
B-572A	460
B-624A, B-624X	460
B-673X	460
B-718, B-718A, B-718X	460
B-725A, B-725X	460
B-742, B-742A, B-742X	460
B-743X	460
B-763X	460
B-764X	460
B-774A	460
B-774X	460
B-819, B-819A, B-819X	460
B-826A, B-826X	460
RA-901	460
W-44	460
W-53	175
W-64	370
W-73, W-82	175
W-83AW	445
W-84	460
W-89	180
W-90	171
W-99, W-99A	171
W-101	171
W-103	175
W-104	370
W-110	171
W-112	175
W-120	171
W-122	175
W-124	460
W-155	460
W-165A, W-165X	460
W-175, W-185X	460
W-254	460
W-410A	460
W-420A	460
W-430A	460
W-511A, W-511X	460
W-512A, W-512X, W-512Y	460
W-521A, W-521X	460
W-527, W-527A, W-527X	460
W-531A, W-531X	460
W-532A, W-532X	460
W-535A, W-535X	460
W-551A, W-551B	460
W-552A, W-552B	460
W-558A, W-577A	460
RA-602	460
W-622, W-622A, W-622X	460
W-622Y, W-622Z	460
W-634	370
W-636A, W-636X	460
W-650A, W-650X	460
W-651A, W-651X	460
W-683A-X, W-684A-X	460
W-785A-X	460
W-801	175
W-802	175
W-813A, W-813X, W-813Y	460
W-823, W-823A, W-823X	460
W-823Y, W-823Z	460
W-837A, W-837X, W-837Y	460
W-886A-X-Y	460

(Cont'd)

WESTINGHOUSE (CANADIAN)—(Cont'd)

Model	kc
W-914X, W-914Y	460
W-955A, W-955X	460
W-981A, W-981X	460
W-987-X	460
W-1015X, W-1015Y	460
W-1029X, W-1029Y	460
W-1038X, W-1038Y	460
W-1156X, W-1182X	460
W-1230X	460
W-1239X	460
W-1516X	460
560A, 560B, 665B	460
665X, 667A, 667X	460
757X, 780A, 780B	460
780X, 780Y	460

WESTONE RADIO CORP.

Model	kc
11, 12	456
34 (4 tubes)	456
34 (5 tubes)	456
40	456
70, 70C	456

WHOLESALE RADIO SERVICE CO.

(See Lafayette)

WILCOX-GAY (Wilcox-Gay Corp.)

Model	kc
A-1, A-2	175
A-3, A-4	456
A-5, A-6	456
A-7, A-8	456
A-9, A-10	456
A-11	175
A-12, A-13	456
A-15, A-16, A-17	175
A-18, A-19	175
A-20	175
A-21	456
A-22, A-23	175
A-24, A-25	175
A-26	456
A-27, A-28, A-29	175
A-30, A-31	456
A-32, A-33, A-34	175
A-35, A-36, A-37	456
A-40	175
A-41, A-42, A-43	456
A-44, A-45	456
A-46	175
A-48, A-49, A-50	456
A-52, A-53, A-54, A-55	456
A-69, A-70, A-73	456
A-78, A-79, A-81	456
A-85, A-87, A-88	456
A-89, A-90, A-91	456
A-92, A-93, A-94	456
A-100	456
A-104, A-105	456
A-106	4300
A-107, A-111, A-112	456

(Cont'd)

WILCOX-GAY—(Cont'd)

Model	kc
A-113, A-114, A-115, A-115B	456
C16	175
2-S-5, 2-T-5, 2-VA-7	175
2VB7, 2VB7-67	175
3-D-5	175
3F7, 3F7-67	115
3J-4-11	175
3J-5	175
3J-5-55	175
3J6-5	175
3JD5	115
3JE5, 3JE5-93, 3JF5	175
3JG5	115
3-JM-6, 3JQ6	175
3-K-5	175
3KD5	115
3KE5, 3-KE-5-26	175
3LB7, 3LB7-22-24	175
3LB7-22-706	175
3LB7-24A, 3LB7-706	175
3-PA-6-66	115
3-R-6	175
3S-5-66	175
3SB-5	175
3SB-5-66	175
3-T-6-66	175
3V6, 3VA6, 3VB6	175
3-VB6-73, 3-VB6-710	175
4B6, 4B6-2	175
4BE-6	456
4C5, 4CA5	175
4CB5, 4CD5, 4CD5-29	175
4D10, 4DB10	175
4E6	115
4G7, 4H11-740	456
4J6, 4JA6, 4JB6	456
4JC6, 4JC6-84	456
4JC6-780	456
5A6, 5A6-89, 5A6-810	456
5B5-89, 5B5-800	456
5BA-5	456
5BE-6	456
5E-7	456
5E-7-91	456
5E-7-780	456
5EA-7	456
5E7-780, 5EA7	456
5F8-90, 5F8-790	456
6A-5, 6B-8	175
6BB-8, 6D-6	175
6F6, 6FB6	175
6J4, 6P4	175
6S12, 6T11	456
7A5	175
7AB5	115
7AC5, 7C6, 7CB6	175
7D6	175
7E5, 7EA5	456
7G5, 7GB5, 7H5	175
7J7, 7K7, 7R5	456
7RA5, 7S5, 7T5	456
8A5, 8D5, 8E5	456
8J5, 8L7	456

WILLYS

(Also see Willys Models listed under Philco)

Model	kc
W-1419	260

WINGS (Goodyear Tire & Rubber Co., Inc.)

(See Listings under Goodyear Service)

WIZARD (Champion Radio Labs.)

Model	kc
4385P	465
5238	465
5338	465

RUDOLPH WURLITZER & CO.

(Lyric, Wurlitzer. See also listings under American Mohawk Corp.)

Model	kc
A-60	485
B-6, B-80	175
C-4	456
DC-65	175
LU-5	456
LW5	125
M-4	456
P-5	456
S-6, S-7, S-8, S-10	175
S-41	456
S-50, S-63, S-65, S-80	175
SA-5, SA-6, SA-65	175
SA-90, SA-91	175
SA-91-A, SA-99	175
SA-110, SA-111, SA-120	175
SA-130, SA-133	175
SH-9, SH-500, SH-501	175
SU-5	456
SW-8, SW-80, SW-88	485
U-50	456
U-50 (Early), U-55	485
U-500	456
450, 451, 452	456
454	370
460	175
470, 470-A	370
471, 480	370

YORKER

(See Espey Mfg. Co., Inc.)

ZENITH (Zenith Radio Corp.)

Model	kc
De Luxe	485
Stratosphere	485
AH, BH, CH, LH, LHB	175
MH, MHA, NH, RH, WH, WHA	175
S-829, S-847	252.5
S-870, S-871	252.5
S-908, S-909, S-961, S1170	252.5
V-8	175
4-B-106	456
4-B-131, 4-B-132, 4-B-231	456

(Cont'd over)

ZENITH—(Cont'd)

Model	kc
4B-313	455
4-B-314	455
4B-317	455
4B-355	455
4B-422, 4B-437	455
4B-466, 4B-515	455
4B-533	455
4F-133, 4F-227	456
4K-310	455
4K-329	456
4K-331, 4K-355	455
4K-400 Series	455
4K-402, 4K-422	455
4K-435, 4K-465	455
4K-515	455
4K-600	455
4P-26, 4P-51	456
4-T-26, 4-T-51	456
4-V-31, 4-V-59	456
5F-134, 5F-166	456
5-F-233, 5-F-251	456
5G-401, 5G-438	455
5G-441, 5G-442	455
5G-461, 5G-467	455
5G-484, 5G-500	455
5G-537	455
5-J-217, 5-J-247, 5-J-255	456
5M-90 (auto radio)	456
5M-91 (auto radio), 5M-191 (auto radio)	456
5M-291, 5M-294 (auto radios)	456
5R-123, 5R-135	456
5R-165	456
5-R-216, 5-R-226, 5-R-236	456
5R-303, 5R-312	455
5R-312W, 5R-312Y	456
5R-316, 5R-317, 5R-337	455
5-S-29	252.5
5-S-29A	262.5
5-S-56	252.5
5-S-56A	262.5
5-S-119	456
5-S-126, 5-S-127	456
5-S-150, 5-S-151	456
5-S-161	456
5-S-201, 5-S-218, 5-S-220	456
5-S-228, 5-S-237, 5-S-250, 5-S-252	456
5S-319, 5S-320	455
5S-327, 5S-338	455
5S-330	455
5S-339, 5S-339M	455
5X-230, 5X-248	456
5X-274	456
6-B-107	456
6-B-129	456
6-B-164	456
6B-231, 6B-321	455
6-D-116, 6-D-117	456
6-D-118, 6-D-202, 6-D-219	456
6-D-221, 6-D-238	456
6D-302, 6D-311	455
6D-311W, 6D-311Y	456
6D-312, 6D-312Y	455
6D-312W, 6D-315	455
6D-316, 6D-317	455
6D-326, 6D-336	455
6D-337, 6D-360	455
6D-510, 6D-525	455
6D-526	455
6-J-230, 6-J-257	456
6J-322, 6J-357	455
6J-436, 6J-463	455
6-M-90 (auto radio), 6-M-90-D, 6-M-90-S	252.5
6M-91 (auto radio), 6M-91D, 6-M-91-S	252.5

(Cont'd)

ZENITH—(Cont'd)

Model	kc
6-M-92 (auto radio)	252.5
6-M-192, 6-M-193 (auto radios)	252.5
6-M-194 (auto radio), 6-M-195	252.5
6M-292, 6M-293, 6M-295 (auto radios)	252.5
6M-305, 6M-306	455
6M-390	455
6M-490 (Ford)	455
6MF-590 (Ford)	455
6MN-495, 6MN-496	455
6MN-595, 6P-416	455
6P-417, 6P-418	455
6P-428, 6P-429	455
6P-430	455
6P-447, 6P-448	455
6P-457	455
6R-583	455
6-S-27, 6-S-27A	252.5
6-S-52, 6-S-52A	252.5
6-S-128	456
6-S-137, 6-S-147	456
6-S-152, 6-S-157, 6-S-203	456
6-S-222, 6-S-223	456
6-S-229, 6-S-230	456
6-S-239, 6-S-241	456
6-S-254, 6-S-256	456
6S-301, 6S-304, 6S-305	455
6S-306, 6S-321, 6S-322	455
6S-330	456
6S-340	455
6S-341, 6S-361, 6S-362	456
6S-439, 6S-469	455
6S-511, 6S-527	455
6S-528, 6S-546	455
6S-556	455
6-V-27, 6-V-62	456
7	175
7-D-119	456
7-D-126, 7-D-127	456
7-D-138, 7-D-148	456
7-D-151	456
7-D-162, 7-D-168, 7-D-203	456
7-D-222, 7-D-223	456
7-D-229, 7-D-239	456
7-D-241, 7-D-243	456
7-D-253	456
7-J-232, 7-J-259	456
7J-323, 7J-363	455
7J-368	455
7-M-91 (auto radio)	252.5
7-M-91D, 7-M-91S	252.5
7ML-592 (Lincoln)	455
7MN-596 (Nash)	455
7-S-28, 7-S-30, 7-S-53	456
7-S-204, 7-S-232	456
7-S-240, 7-S-241	456
7-S-242, 7-S-258	456
7-S-260, 7-S-261	456
7S-323, 7S-342, 7S-343	455
7S-363, 7S-364, 7S-366	455
7S-432, 7S-433	455
7S-434, 7S-449	455
7S-450, 7S-458	455
7S-459, 7S-460	455
7S-487, 7S-488	455
7S-490, 7S-529	455
7S-530, 7S-547	455
7S-585	455
8-M-195 (auto radio)	252.5
8-S-129	456
8-S-154	456
8S-359, 8S-432	455
8S-433, 8S-434	455
8S-443, 8S-449	455
8S-450, 8S-451	455
8S-458, 8S-459	455

(Cont'd)

ZENITH—(Cont'd)

Model	kc
8S-460, 8S-463	455
8S-531, 8S-548	455
8S-563, 8S-586	455
9S (chassis 5905)	456
9-S-30, 9-S-34, 9-S-54, 9-S-55	456
9-S-204, 9-S-232	456
9-S-242, 9-S-244	456
9-S-252, 9-S-263, 9-S-264	456
9S-303, 9S-307	455
9S-324, 9S-344	455
9S-365, 9S-367, 9S-369	455
10H-551	
(Amp. Mod.)	455
(Freq. Mod.)	4300
10H-571	
(Amp. Mod.)	455
(Freq. Mod.)	4300
10H-573	
(Amp. Mod.)	455
(Freq. Mod.)	4300
10-S-130	456
10-S-147	456
10-S-153, 10-S-155	456
10-S-156, 10-S-157	456
10-S-160	456
10S-443, 10S-452	455
10S-464, 10S-470	455
10S-491, 10S-492	455
10S-531, 10S-549	455
10S-566	455
11S-474	455
12-A-57, 12-A-58	456
12H-678	
(Amp. Mod.)	455
(Freq. Mod.)	8300
12H-679	
(Amp. Mod.)	455
(Freq. Mod.)	8300
12-L-57, 12-L-58	456
12-S-205, 12-S-232	456
12-S-245, 12-S-265	456
12-S-266, 12-S-267, 12-S-268	456
12S-345, 12S-370, 12S-371	455
12S-445, 12S-453	455
12S-471, 12S-550	455
12S-568, 12S-569	455
12-U-158, 12-U-159	456
15S-308, 15S-346	455
15S-372, 15S-373	455
15S-479, 15S-495	455
15-U-246, 15-U-269	456
15-U-270, 15-U-271	456
15-U-272, 15-U-273	456
16-A-61, 16-A-63	456
090	175
90, 90-A	175
91, 92, 93, 103	175
210	175
210-5, 211-5, 215	175
216, 217, 220, 221, 225	175
230, 240, 241, 244, 245	175
250, 251, 252 (SW Conv.)	1000
(Broadcast I.F.)	175
258	485
260, 261 (SW Conv.)	1000
(Broadcast I. F.)	175
263	175
268	485
270	175
270-5	125
271	175
272 (SW Conv.)	1000
(Broadcast I. F.)	175
277	485
278	485
280, 281	485

(Cont'd)

ZENITH—(Cont'd)

Model	kc
288, 289	485
410, 411, 412, 414, 420	175
430, 440, 441, 442, 443	175
460 (auto radio), 461	485
462 (auto radio)	252.5
470, 472, 473	175
474, 475	175
476, 476-A, 476-B	175
478	485
500, 501, 502, 503, 514, 515, 516	175
517, 518	485
520, 521, 530, 531, 532	175
533	175
550	485
558, 568, 578	485
600, 602, 603, 604, 605	175
606, 607, 608, 610, 611	175
612, 614, 615, 616, 617	175
618, 619, 620, 621	175
622, 623	175
650-HD, 651-HE	252.5
654	456
660-TD, 661-TE	252.5
663, 664 (auto radios)	456
666, 668 (auto radios)	252.5
680	252.5
701, 702	456
705, 706, 707	485
711, 712	485
715	175
730, 735	175
740	175
750	485
755, 756	175
760, 765, 767, 770	175
770-B, 775, 775-B, 780	175
801	456
805, 806	252.5
807, 808	252.5
809, 810, 811	252.5
812, 814, 815	125
825, 827	485
829	485
834, 835	485
845	252.5
847	252.5
850, 860, 861, 862	252.5
864	125
865, 866	252.5
870, 871, 880, 881	485
908, 909	252.5
912, 932	125
945, 950	252.5
960, 961	252.5
963	252.5
970, 975	175
980, 985	485
990, 1000Z	485
1001, 1001A	485
1004	456
1101, 1102	485
1115	252.5
1117	252.5
1161	125
1162, 1167, 1170	252.5
1201, 1201-A	485
1202, 1203, 1204	456
1501, 1601-C, 1601-P	456
2012, 2012-J, 2017	175
2022, 2022-A	175
2032	175
2047	485
2052, 2053, 2054	175
2056	485
2059	175
2062	125
2501-C, 2501-P	485

(Cont'd)

ZENITH—(Cont'd)

Model	kc
5401, 5403	456
5405, 5406, 5408, 5409	456
5502, 5504	252.5
5505, 5508, 5509	252.5
5510	456
5513, 5513A	252.5
5516, 5520, 5521	456
5522, 5524, 5526	456
5605, 5607	252.5
5608	125
5609	252.5
5611, 5612	125
5614, 5616, 5617, 5618	252.5
5619	252.5
5621	456
5633, 5634	456
5637	252.5
5638, 5639	456
5642, 5644	456
5701, 5702, 5703	485
5701-R, 5702-R, 5703-R	252.5
5704	456
5707, 5709, 5710, 5711	456
5801	456
5803	252.5
5901	456
5902	175
5903, 5905	456
5908	252.5

ZEPHYR
(Zephyr Radio Co.)

Model	kc
AA, A5	456
B102	456
D, DA, DB, DBC	456
DBL, DC, DD	456
DDB, DF, DL	456
G, GB, GB32	456
GBC, GBC32, GBE	456
GE, GR, GRC	456
J-80, NT, NTC, NTE	456
P, TA	456
TSA-105	456
2M7, 3M5 (auto radio)	456
3M7	262
3M8	262
5DA, 5DK	456
6G, 6GM	456
8J, 8JM	456
20A6, 21A6, 22A6	456
20B6, 21B6, 22B6	456
20P6, 21P6, 22P6	456
20X7, 21X7, 22X7	456
24A5	456
25B5	456
25B7	456
25Y11, 26Y11	456

(Cont'd)

ZEPHYR—(Cont'd)

Model	kc
30B7, 31B7, 32B7	456
30P7, 31P7, 32P6	456
30X7, 31X7	456
30Y9, 31Y9	456
30YP6	456
31YP6	456
32B7, 32P6	456
32Y5, 32Y6	456
33B6	456
35B7, 35P6, 35Y12	456
39Y6	456
39YP5	456
40Y6, 40Y8	456
40Y8C	456
41X6, 42X5	456
42X6	456
46X6	456
50X5	456
50Y14, 51Y15	456
61X5, 61X6, 61X8	456
62X8	456
63X8	456
64X8, 64Y8	456
65X8	456
153-5L	455
352-5R	455
381-7H	455
576-5Q	455
577-5Q	455
605-7C	456
666-6J	455
667-6J	455
668-6J	455
669-6J	455
696-6M	455
697-6M	455

USE THIS SPACE FOR RECORDING I-F's OF ADDITIONAL MAKES & MODELS OF RECEIVERS

Model	kc

END

CROSS-INDEX OF MODEL NUMBERS OF AMERICAN RCA AND RCA-VICTOR WITH THOSE OF CORRESPONDING AMERICAN GENERAL ELECTRIC, WESTINGHOUSE & GRAYBAR RECEIVERS

RCA & RCA-Victor (Amer.)	*General Electric (American)*	*Westinghouse (American)*	*Graybar (American)*
SW-2	JZ-30	———	———
R-4	J-70	WR-17	GT-7
R-5	T-12	WR-14	GB-4
R-5-DC	T-12-D	———	———
R-5-X	T-12-E	WR-14-CR	———
T-5	E-52	WR-9	———
R-6	J-75	———	GC-13
R-7	S-22 & S-22-X	WR-10	GB-8
R-7A	S-22 (2)	WR-10-A	GB-8-A
R-7DC	S-22D	———	———
R-8	J-80	WR-18	GT-8
R-9	S-42	WR-12	———
R-10	S-132	WR-15-A	GB-989
R-11	K-62	WR-15	GB-9
R-12	J-85	———	GC-14
Radiola 16	———	———	GB-300
RE-16	SZ-42-P	WR-13	———
RE-16-A	———	WR-13-A	———
R-17-M	BX or K-41	WR-26-M	———
RE-18 & RE-18A	KZ-62-P	———	———
R-18-W	K-40-A	———	———
Radiola 18	———	———	GB-310
Radiola 21	B-1	———	———
Radiola 22	B-2	———	———
R-22-S	L-50	———	———
R-22-W	L-51	———	———
RO-23	JZ-835	WR-16	———
R-24	JZ-822	———	———
R-24-A (with 47's)	JZ-822-A	WR-24	———
R-24-A (with 2A5's)	———	WR-24	———
R-27	K-40	WR-26	———
R-28	K-50	———	———
R-28-P	K-50-P	———	———
R-28-P (A to G)	K-51-P	WR-27	———
M-30	A-90	———	———
P-31	A-81	———	———
M-32	A-60	———	———
Radiola 33	———	———	GB-311
M-34	B-40	WR-33	———
34E	K-88X	———	———
R-37	K-60	———	———
R-37-P	K-60-P	WR-28	———
R-38	K-65	———	———
R-38-P	K-65-P	———	———
RE-40	K-54	———	———
RE-40-P	K-54-P	WR-29	———
R-43	S-42-B	———	———
Radiola 44	———	———	GB-500
Radiola 46	———	———	GB-550
Radiola 48	T-41	WR-4	GB-678
R-50	H-32	———	———
Radiola 51	———	———	GB-320
R-55	———	———	GB-100
RAE-59	H-72	———	———
Radiola 60	———	———	GB-330
Radiola 62	———	———	GB-340
Radiola 66	———	———	GB-600
R-70 & R-70-N	J-72	WR-21	———
R-71	J-82	WR-19	GT8-56
R-72	J-86	———	GT8-69
R-73 (with 47's)	J-83	WR-22	———

(Cont'd at top of next column)

RCA & RCA-Victor (Amer.)	*General Electric (American)*	*Westinghouse (American)*	*Graybar (American)*
—(*Cont'd*)			
R-73 (with 2A5's)	J-83-A	———	———
R-74	J-100	WR20	GT10-69
R-75 (with 47's)	J-87	———	———
R-75 (with 2A5's)	J-87-A	———	———
R-76	J-105	———	GT10-88
R-77	J-107	———	GT10-99
R-78	J-125	———	———
R-78 (2)	J-125-A	———	———
RE-80	———	WR-23	———
Radiola 80	H-31	WR-5	GB-700
RE-80-SW	———	WR-25	———
RE81	J-109	———	———
Radiola 82 & 82-R	H-51 & H-51-R	WR-6 & 6-R	GB-770
Radiola 86 & 86-R	H-71 & H-71-R	WR-7 & 7-R	GB-900
R-90	K-106	———	———
R-90P	K-106-P	———	———
91-B	C-30	———	———
100	K-43	WR-32	———
R-100	J-100	———	———
101	M-41	———	———
M101	D-50	———	———
102	M-40	———	———
103	M-42	———	———
M104	D-51	———	———
M-105	C-41	WR-41	———
M-107	C-60	———	———
M108	D-52	———	———
M109	D-72	———	———
110	K-52	———	———
111	K-53	WR-35	———
112	L-52	WR-34	———
112A	L-52A	———	———
114	L-53	———	———
115	K-53-M	———	———
M-116	B-52	WR-42	———
117	M-50	———	———
118	M-51	WR-48	———
119	M-52	———	———
120	K-63	WR-36	———
121	K-64	WR-37	———
M-123	C-61	———	———
124	M-63	———	———
125	M-62	———	———
126-B	C-62	———	———
127	K-64-D	———	———
128	M-61	WR-46	———
128-E	———	WR-50	———
135-B	C-70	WR-47	———
140 & 140-E	K-80	WR-30	———
141 & 141-E	K-80-X	WR-31	———
142-B	B-81	———	———
143	M-81	WR-45	———
210	K-55	———	———
211	M-56	———	———
214	M-55	———	———
220	K-66	———	———
221	M-65	———	———
222	K-66-M	———	———
223	C-67	———	———

(Cont'd on next page)

CROSS-INDEX—(Cont'd)

RCA & RCA-Victor (Amer.)	General Electric (American)	Westinghouse (American)	Graybar (American)
—(Cont'd)			
224	M-67	———	———
226	M-66	———	———
235-B	C-75	———	———
240	K-85	———	———
241-B	B-86	———	———
242	M-86	———	———
243	M-85	———	———
R260	K-107	———	———
261	K-105	———	———
262	M-106	———	———
263	M-107	———	———
280	K-126	———	———
281	M-125	———	———

(Cont'd at top of next column)

RCA & RCA-Victor (Amer.)	General Electric (American)	Westinghouse (American)	Graybar (American)
—(Cont'd)			
300	K-48	———	———
301	M-49	———	———
310	K-58	———	———
Duo 321	M-68	———	———
322	M-69	WR-49	———
330	K-78	———	———
331	K-79	———	———
340	K-88	WR-38	———
340-E	K-88-X	WR-39	———
341	M-89	———	———
380 (Duo)	M-128	———	———
Duo 380-H.R.	M-128-R	———	———
Duo 381	M-129	———	———

AMERICAN G. E. & WHS'E MODELS WHICH DO NOT HAVE RCA & RCA-VICTOR EQUIVALENTS

General Electric Models:

H-91 (this is the G. E. H-51 receiver chassis (modified) in a Clock Cabinet)
H-91R (this is the G. E. H-51R receiver chassis (modified) in a Clock Cabinet)
J-88 (this is the G. E. J-82 receiver chassis with a Manual Motor Board)
J-109 (this is the G. E. J-100 receiver chassis and Automatic Motor Board)
JZ-826 (this is the G. E. JZ-822 receiver chassis in a Console Cabinet)
JZ-828 (this is the G. E. J-88 receiver chassis with a Short Wave Adapter)
K-82 (this is the G. E. K-62 receiver chassis in a Clock Cabinet)

Westinghouse Models:

WR-8 (this is the Westinghouse WR-6 Chassis with a Clock in the Columaire Cabinet)
WR-8R (this is the Westinghouse WR-6R Chassis modified for vertical operation in a Columaire Cabinet)

CROSS-INDEX OF MODEL NUMBERS OF AMERICAN RCA AND RCA-VICTOR WITH THOSE OF CORRESPONDING CANADIAN RCA, GENERAL ELECTRIC AND WESTINGHOUSE RECEIVERS

RCA & RCA-Victor (Amer.)	*RCA & RCA-Victor (Can.)*	*General Elec (Canadian)*	*Westinghouse (Canadian)*
SW2	SWA 102	JZ-30	
R-7	R-7, R-78	S-22, S-22X	W-801
R-7A	R-7A, R-8A, R-9A R-104, R-105	H-77, S-42A	W-801
R-8	R-8	S-42	.....
R-9	.....	.....	W-801
R-10	R-8, R-10, R-12, R-107	J-85	.....
R-11	R-15	K-62	.....
R-12	R-10, R-12	J-85	.....
Radiola 16	.....	.....	W-16
RE-16	RE-37	H-77	.....
Radiola 17	.....	.....	6AC-1927/28
RE-18, RE-18A	RE-41	.....	.....
Radiola 18	.....	.....	6AC-1928/29
Radiola 20	.....	.....	W-55
R-21, R-22	R-20, R-20R, R-109	.....	.....
RO-23	RO-112	.....	W-112
R-28	R-28	K-50	W-53
R-28P	R-29, R-31	K-52, K-53	W-53
R-28P (A to G)	.....	.....	W-53
Radiola 33	.....	.....	6AC-1928/29
M-34	M-34	B-40	A-43
R-37	R-37	K-60	.....
RE-40P	RE-33	.....	.....
Radiola 42	.....	.....	W-61, W-71, W-81
R-43	R-30	S-42B	.....
Radiola 48	R-15, Radiola 48	T-41	W-61, W-71, W-81
R-50, R-55	R-20, R-21	H-32	.....
R-51B, R-53B	.....	.....	B-103
RAE-59	RAE-59	H-72	.....
Radiola 66	.....	.....	W-89
R-70, R-70N	R-48	J-72, J-76	.....
R-71	R-50	J-82	W-82
R-71B	R-6, R-67, R-68	JB-83, JB-87	B-83
R-72	R-52	J-86	W-82
R-73 (47)	R-53	.....	.....
R-74, R-76, R-77	R-54, R-56	J-105, J-107	.....
R-78	R-22	J-125	W-122
RE-80	RE-80	.....	.....

(Cont'd at top of next column)

RCA & RCA-Victor (Amer.) —*(Cont'd)*	*RCA & RCA-Victor (Can.)*	*General Elect. (Canadian)*	*Westinghouse (Canadian)*
Radiola 80	R-35, Radiola 80	H-31	W-101
Radiola 82, 82-R	R-39, Radiola 82	H-51	.....
Radiola 86, 86-R	RE-57, Radiola 86	H-71	.....
RAE-84	RAE-84	.....	.....
RE-81	RE-81	.....	.....
R-90	90	K-106	W-103
R-90P	.....	.....	W-104
100, 101	101	M-41, M-42	W-44
M-105	M-105	C-41	A-44
110, 111, 115	R-31	K-52, K-53, K-59	A-53, W-53
M-116	M-116	B-52	.....
118	118	M-51, M-52	W-155, W-254
120	.....	K-57	W-53
121, 122	.....	K-64, M-62, M-69	W-64, W-634
M-123	M-123	C-61	.....
126-B	126-B, 223-B	L-6B, L-6CB	B-64
128	128	M-61	W-165A
135B	135-B	M-7B	.....
140, 140E, 141	140	K-80, K-85	W-83AW
141E, 141	.....	.....	W-83AW
142B, 241B	R-87	K-8B	.....
143	143	M-81	W-84, W-185X
211	211	M-56	W-155, W-254
220	222	.....	.....
221	122, 221	.....	.....
222	222	.....	.....
223	126-B, 223-B	L-6CB	B-634
224	224	M-67	W-165X
235B	235B	M-7CB	B-74, W-185X
241B, 142-B	R-88	K-8CB	.....
242	242	M-86	W-84
262	262	M-106, M-107	.....
280	280	K-126	.....
281	281	M-125	W-124
321	321	.....	.....
330	R-49	.....	W-73
331	331	K-79	.....
340	340	.....	.....
381	381	.....	.....
788(2)	R-22A	J-125A	W-122A

— 7 —

TROUBLE-SHOOTING "REMINDER" CHART FOR COMMON "HOME-RADIO" RECEIVER TROUBLES

IT is apparent that there are a great many causes of inoperation or poor operation of "home-" and "auto radio" receivers; in fact, it is the distinct purpose of the textbook *Modern Radio Servicing** to discuss the servicing of modern radio receivers in detail. The chart presented in this section has been compiled for the purpose of presenting a quick-reference outline of the salient causes of some of the more common troubles which occur in both battery-operated and line-operated "home" receivers of all types . . . and to point out the most likely remedies for them.

It must not be inferred that this chart is intended to be a complete servicing guide in itself. It was really compiled to act as a convenient *reminder* or trouble outline to which the radio service man can refer when he is "trouble-shooting" a receiver, so he can make sure that he has not overlooked some possible cause of the trouble symptom which the receiver is exhibiting. This makes it unnecessary for him to remember each of the 402 possible receiver troubles and trouble sources which the chart lists. After he has checked over the receiver in the usual way he can refer to this trouble-shooting chart to see if he has overlooked some possible cause of the trouble.

Examination of this chart will show that for each of the eight common receiver trouble symptoms specified, several possible sources or causes of trouble are listed for each main part of the receiver. Thus, for the symptom of "Weak reception", *six* likely causes of trouble in the "Tubes" of the receiver are listed, *eight* likely causes of trouble in the "Rectifier and Filter Circuits" are pointed out, etc. Of course, each of these possible causes of the trouble would have to be checked by making suitable tests on the particular components of the receiver which the chart points out, in order to track the trouble down definitely to the guilty component. Therefore, this chart serves best as a *trouble reminder.*

While many of the causes may appear simple to those who have been in the radio servicing business for some time, those just entering the radio servicing profession, to be good service men, must know the simple troubles as well as those that are difficult to diagnose. It is suggested that this chart be kept handy for ready reference.

A similar chart for trouble-shooting *"Auto-Radio"* receivers is presented in the next section (*Sect. 8*). Here again, each of the possible causes of trouble for any trouble symptom the receiver exhibits must be checked by making suitable tests on the particular receiver components which the chart points out. In this way, the guilty component may be tracked down.

*NOTE: *MODERN RADIO SERVICING* by *Alfred A. Ghirardi.* Published by RADIO & TECHNICAL PUBLISHING CO., 45 Astor Place, N. Y., N. Y.

(Chart begins on following page)

TROUBLE-SHOOTING "REMINDER" CHART FOR COMMON "HOME-RADIO" RECEIVER TROUBLES

Possible Trouble Sources	*Symptoms of Trouble*							
	"Dead" Receiver	*Intermittent Reception*	*Fading*	*Weak*	*Excessive Hum*	*Oscillation*	*Noisy*	*Distortion & "Rattling"*
Antenna System	1. Ground wire or connection "broken." *Examine.* 2. Lead-in "disconnected" at receiver. *Examine.* 3. "Ant." binding post in receiver "grounded" to chassis. *Ohmmeter test.* 4. Lead-in window strip "broken" in mid-section. *Examine; continuity test.* 5. Lightning arrester "shorted." *Continuity test.* 6. Antenna "grounded." *Ohmmeter test.* 7. Lead-in wire "broken." *Examine; continuity test.* 8. Aerial wire "down." *Examine.*	1. Ground - clamp "loose." *Examine; clean; tighten.* 2. Lead-in wire "grounding" to receiver chassis. *Examine.* 3. Aerial or lead-in wire "grounding" or "shorting" to a nearby aerial or grounded object. *Examine both the aerial and lead-in; Ohmmeter test.* 4. "Loose" or "corroded" joint between lead-in and aerial wires. *Examine; clean; tighten.* 5. Lead-in window strip "broken" in mid-section — or wires loose. *Examine; continuity test.*	1. Ground clamp "loose." *Examine; clean; tighten.* 2. Lead-in wire "grounding" to receiver chassis. *Examine.* 3. Aerial or lead-in wire "grounding" or "shorting" to a nearby aerial or grounded object. *Examine; ohmmeter test.* 4. Lead-in window strip "broken" in mid-section — or "wires loose." *Examine; continuity.* 5. Lead-in wire "snapped." *Examine.* 6. "Loose." "swinging" aerial wire. *Examine; tighten.* 7. "Loose" or "corroded" joint between lead-in and aerial wires. *Examine; clean; tighten.*	1. No ground wire. *Examine; test receiver with a "ground."* 2. Ground clamp contact "loose." *Examine; clean; tighten.* 3. Lead-in wire "grounding" to chassis. *Examine.* 4. Aerial or lead-in "grounded" or "shorted" to nearby aerial or grounded object. *Examine; ohmmeter test.* 5. Lightning arrester "shorted." *Continuity test.* 6. Lead-in window strip "broken" in mid-section — or wires loose. *Examine; continuity test.* 7. "Loose" or "corroded" joint between lead-in and aerial wires. *Examine; clean; tighten.* 8. Aerial wire "down;" too near large "grounded" metallic object; "too short;" in "shielded" location. *Examine.*	1. "No "ground" connection; "loose" ground clamp; or an otherwise "poor" ground. *Try a "ground" on radio. Examine; clean; tighten gnd. connections.* 2. Hum pick-up by receiver "grounding" system. *Remove ground wire. If hum stops, operate receiver without a ground, or install a "doublet" antenna system (for which no ground wire is necessary).* 3. Aerial or lead-in wires too close (or parallel to) power lines or line-supply cord at receiver. *Examine; re-locate.* 4. Aerial or lead-in wires too close to those of an oscillating receiver. *Examine; re-locate.* 5. Aerial or lead-in wires striking grounded object. *Examine; ohmmeter test.*	1. No "ground" connection; "loose" ground clamp; or an otherwise "poor" ground. *Try a "ground" on radio. Examine; clean; tighten gnd. connections.* 2. Aerial wire "too short." *Examine; lengthen.* 3. Aerial or lead-in wires "too close" to those of another re-radiating antenna. *Examine; re-route.*	1. Test antenna system for "noise pickup" by disconnecting both lead-in and ground wires from set. *If this stops (or reduces) the noise, at least part of it is being picked up by the antenna system. Shorten aerial wire if it is too long; re-locate aerial and lead-in out of zone of electrical disturbances; install a noise-reducing antenna system if necessary.* 2. Lightning arrester "defective." *Substitute.* 3. "Ground" clamp "loose." *Examine; clean; tighten.* 4. Lead-in window strip "broken" at center, or "loose" connection. *Examine; ohmmeter test.* 5. Aerial or lead-in "leaking" or "grounding" to nearby aerial or grounded object. *Examine; ohmmeter.*	1. Antenna system has "insufficient signal pickup" (weak "distorted" reception). *Lengthen aerial wire, or re-locate for better signal pickup.* 2. Antenna signal "pickup too great" ("overloads" receiver and causes "distortion" and rattling"). *Shorten aerial wire, or insert a 0.00005-mfd. series condenser in lead-in.*
"A" Battery (if used)	1. Battery "exhausted." *Hydrometer test (storage batt.). Voltage test (dry or Air-Cell batt.).* 2. "Dead" cell. *Hydrometer or voltage test.* 3. Storage battery needs water. *Examine; refill.* 4. Broken or corroded "A" lead contacts at battery. *Inspect; clean; tighten.* 5. "A" battery connections "reversed." *Examine; voltmeter test for battery polarity.* 6. Rectifier or filter system in "A" eliminator needs replacement. *Output voltage test with receiver "on."*	1. "Loose" or "corroded" connection to battery. *Examine; clean; tighten.* 2. "Intermittent" "open" or "short" in battery cable. *Shake and pull wires of battery cable with ohmmeter connected to each in turn and between leads.*	1. Battery connections "loose" or "corroded." *Examine; clean; tighten.* 2. Battery needs water. *Examine; refill.* 3. Battery fairly well "exhausted." *Hydrometer test, or voltage test (with receiver turned "on"), when fading occurs.*	1. "Loose" or "corroded" connections to battery. *Examine; clean; tighten.* 2. Water level "low." *Examine; add water; recharge.* 3. Battery "exhausted." *Hydrometer test; voltage test with receiver turned "on."* 4. "Dead" cell. *Hydrometer test; voltage test with receiver turned "on."* 5. Charger "not functioning properly." *Check charger for output voltage under load.*	1. Battery charger operating while receiver is in operation. *Examine.* 2. Battery "exhausted." *Hydrometer test; check voltage with receiver "on" full.* 3. "Defective cell." *Hydrometer test; check voltage with receiver "on" full.* 4. "Poor connections" to battery. *Examine; clean; tighten all battery connections.*	1. Battery "exhausted." *Hydrometer test; voltage test with receiver turned "on" full.*	1. Battery "exhausted" and "sulphated." *Hydrometer test; voltage test under load.* 2. Water level "low." *Examine; add distilled water.* 3. Terminals "corroded." *Examine; clean; tighten.*	1. Battery exhausted (signals weak & distorted). *Hydrometer test; check voltage with receiver turned "on" full.* 2. Connections to battery "corroded" (signals weak & distorted). *Examine; clean; tighten.*

Continued on next page

"B" Battery (if used)	1. Battery "exhausted." (Replace 45-volt "B" battery units when their voltage drops to about 35 volts *under load.*) *Voltmeter test with radio turned "on" full.* 2. Broken or corroded connections to battery. *Voltage test; examine; clean; tighten.* 3. Battery connections "reversed." *Examine; voltmeter test for battery polarity.*	1. "Loose" or "corroded" connections to battery. *Examine; clean; tighten.* 2. Intermittent "open" or "short" in battery cable. 3. "Defective" internal cell-connection. *Voltage test; earphone test across battery (for "noise"). Shake and pull wires of batt. cable, with ohmmeter connected to each in turn, and between leads.*	1. "Defective cell" in batt. *Voltage check (with receiver turned "on") when fading occurs.* 2. Battery "exhausted" (a 45-volt "B" battery unit should be replaced when its voltage has dropped to about 35 volts under load). *Check battery voltage with receiver turned "on" full.*	1. Battery "exhausted" (a 45-volt "B" battery unit should be replaced when its voltage has dropped to about 35 volts under load). *Check battery voltage with receiver turned "on" full.* 2. "Intermediate," and "high" voltage, connections to battery "reversed." *Examine.*	1. Battery "exhausted" (a 45-volt "B" battery unit should be replaced when its voltage has dropped to about 35 volts under load). *Check battery voltage with receiver turned "on" full.*	1. Battery "exhausted" (a 45-volt "B" battery unit should be replaced when its voltage has dropped to about 35 volts under load). *Check voltage with radio turned "on" full.* 2. "Defective" cell" in battery. *Shunt a 1-mfd. condenser directly across the battery terminals.* 3. "Det." or "Int." "B" voltage "too high." *Try lower voltages.*	1. Battery "exhausted" (a 45-volt "B" battery unit should be replaced when its voltage has dropped to about 35 volts under load). *Check voltage with radio turned "on" full.* 2. "Defective" internal connection. *Make earphone test of each section for "noise;" substitute.* 3. "Dead" or "noisy" cell. *Check voltage under load; earphone test.*	1. Battery exhausted (a 45-volt "B" battery unit should be replaced when its voltage has dropped to about 35 volts under load). *Check voltage with receiver turned "on" full.*
Tubes	1. Grid cap and tube shield "shorting" to each other (touching). *Examine.* 2. Tube "burned out," "shorted." *Tube checker.* 3. High "contact resistance" at grid prong or cap of oscillator tube *Clean and tighten.* 4. Tube prong contacts "faulty." *Examine.* 5. Oscill. tube "flat" (not oscillating). *Substitute.* 6. Series - connected pilot lamp "burned out." *Make continuity test.* 7. Ballast resistor or tube burned out (ac-dc receivers). *Continuity test.*	1. Tube shields "shorting" to control-grid caps or leads. *Examine.* 2. Tube elements "loose" or "shorting." *"Tap" test.* 3. "Imperfect contacts" at tube prongs or grid caps. *Examine; clean; tighten.* 4. Tube heater "opening" intermittently. *Look for light while receiver goes "dead;" tube checker.* 5. "Flat" oscillator tube (tube not oscillating properly). *Substitution.*	1. Grid caps or clips "corroded" or "loose." *Examine; clean; tighten.* 2. "Corroded," or "loose" contacts between tube shields and bases or chassis. *Examine; clean.* 3. "Imperfect contacts" at tube prongs. *Examine; clean; tighten.* 4. Tube elements "loose," or "shorting." *"Tap" test; tube checker.* 5. Tube heater "opening" intermittently. *Examine for light as receiver fades; tube checker.* 6. Cathode - heater "leakage." *Tube checker.*	1. "High - resistance" contact at grid prong or cap of tube (especially oscill. tube). *Examine; clean.* 2. "Wrong type" *Examine; check type numbers.* 3. *"Imperfect"* contacts at tube prongs. *Examine; clean; tighten all contacts.* 4. Weak or "gassy" tubes. *Tube checker.* 5. Cathode - heater "leakage." *Tube checker.* 6. "Flat" oscillator tube (does not oscillate). *Substitute a new tube.*	1. Rectifier tube "weak" or "defective." *Tube checker.* 2. Cathode - heater "leakage." *Check all tubes with tube checker.* 3. "Short" in heater-type tube. *Tube checker.* 4. Push-pull power tubes "unmatched." *Tube checker.*	1. Tube shields "not making good contact" with "chassis." *Examine; clean; tighten.* 2. "Wrong type" tubes. *Check "type" numbers.* 3. "Gassy," "high-emission" tubes. *Tube checker.*	1. Tubes "noisy." *"Tap" test.* 2. Tube shields not making firm contact with chassis. *Examine; clean; tighten.* 3. Contacts at tube socket prongs or grid caps "loose" or "corroded." *Examine; clean; tighten.* 4. Tubes "weak." *Tube checker.* 5. Tube elements "shorting." *Tube checker.* 6. *Cathode - heater* "leakage." *Tube checker.*	1. "Wrong type" tubes. *Check "type" numbers.* 2. "Rattling" caused by "loose" tube shields. *Tighten.* 3. "Microphonic" tubes, or "shorting" elements in tubes. *"Tap" test; tube checker.* 4. Tube prongs "dirty," "corroded." *Examine; clean.* 5. "Gassy," "high-emission" tubes. *Tube checker.* 6. Tubes "weak" (especially power tubes). *Tube checker.* 7. Cathode - heater "leakage." *Tube checker.* 8. Detector tube needs replacement. *Tube checker.* 9. Output push-pull tubes "mismatched." *Tube checker.*
Receiver Circuits Proper *(Cont'd)*	1. "On-off" switch "defective." *"Wiggle" switch control while checking voltage at switch.* 2. Voltage - divider "open." *Check voltage, cont.* 3. Plate or grid resistor "open." *Check voltage; ohmmeter test.* 4. A.F. transformer (prim. or sec.) "open." *Check voltage, continuity.* 5. Bias resistor "open" or "shorted." *Voltage test; check continuity.*	1. "On-off" switch defective. *"Wiggle" switch control while checking voltage at switch.* 2. Voltage - divider (or other resistor) "open-circuiting." *Voltage check; ohmmeter.* 3. Wire-wound resistor terminal rivets "loose," element warped and "shorting" to metal enclosure or chassis. *Examine; ohmmeter.* 4. Resistors or leads "shorting" together, or to chassis. *Examine; continuity tests.*	1. "On-off" switch "defective." *"Wiggle" switch control while checking voltage at switch.* 2. Resistors "shorting" to one another, or "grounding" to chassis. *Examine.* 3. Open - circuiting resistor in AVC circuit. *Check voltages; ohmmeter test.* 4. "High - resistance" leaks. *Ohmmeter test.* 5. Volume - control contacts "dirty" or "corroded." *Examine; ohmmeter test.*	1. Voltage - divider resistors "open" or "changed value." *Check voltages; ohmmeter test.* 2. Grid or plate resistor or suppressor "open" or "grounded." *Check voltages; ohmmeter test.* 3. Diode load resistor "changed value." *Ohmmeter.* 4. Plate choke "open" or "shorted." *Check voltage; ohmmeter test.* 5. A-F transformer winding "open." *Check voltage; ohmmeter test.*	1. Hum-control or "balancer" out of adjustment. *Examine; readjust.* 2. Center-tapped, or other "hum-control" resistor, "open." *Ohmmeter test.*	1. Audio oscillation ("howl"). *Tuning condenser not floating freely in its rubber mountings. "Free" the condenser.* 2. Code signals breaking through. *Adjust wave trap—or install one.* 3. "Wrong tube" in socket. *Check "type" numbers.* 4. Tuned circuits "not aligned properly." *Resonance test, follow alignment procedure.*	1. Tuning condenser plates "burred," "peeling" or "shorting." *Examine; clean; adjust.* 2. Tuning condenser rotor-wiping fingers "dirty" or "corroded." *Examine; clean; adjust.* 3. Waveband switch contacts "loose," "dirty," or splashed with solder. *Examine; clean; adjust.*	1. "Wrong tube" in socket. *Check "type" numbers.* 2. "C" (bias) cell (where used) needs replacement. *Substitute a similar "new" cell, or check plate current of tube and compare with that when a similar bias from a dry cell "C" battery is applied.* 3. Bias resistor "shorted," "open," or "too high." *Check bias voltages; ohmmeter test.*

—Continued on next page—

TROUBLE-SHOOTING "REMINDER" CHART FOR COMMON "HOME-RADIO" RECEIVER TROUBLES—*(Cont'd)*

Possible Trouble Sources	*Symptoms of Trouble*							
	"Dead" Receiver	*Intermittent Reception*	*Fading*	*Weak*	*Excessive Hum*	*Oscillation*	*Noisy*	*Distortion & "Rattling"*
Receiver Circuits Proper *(Cont'd)*	6. Diode load-resistor "open." *Check voltage; ohmmeter test.* 7. Bypass cond. "shorted." *Condenser tester.* 8. "Coupling," or "isolating" condenser in a-f amplif. "open" or "shorted." *Cond. tester.* 9. Grid-return condenser "open" (receivers with AVC). *Condenser tester.* 10. Tone-control resistor or condenser "shorted." *Continuity test; condenser tester.* 11. Wire or connection "broken." *Examine all wiring; test continuity of circuits.* 12. Insulation damaged, wire "grounding" to chassis. *Examine; ohmmeter test.* 13. R-F, i-f, or oscillator coil "open." *Check voltage, continuity.* 14. Coil lugs "shorting" to shield or chassis. *Examine; ohmmeter test.* 15. Gang condenser section, trimmer, or padder "shorted." *Continuity test.* 16. "No reception" over part of dial. *Examine waveband-switch wipers for dirty contacts. Check oscillator bias-resistor value.* 17. Oscill. circuit out of alignment. *Align, test.*	5. Audio trans. winding "open-circuiting." *Voltage check; continuity and ohmmeter.* 6. Leads "shorting" to chassis (insulation cut by sharp edges of holes in chassis where wires run through). *Examine.* 7. Contacts or soldered connections "loose." *Examine; tighten, resolder.* 8. "Ant." binding post "shorting" to chassis. *Examine; ohmmeter test.* 9. By-pass cond. "shorts," "leaky." *Cond. tester.* 10. Audio "coupling" or "isolating" condenser "shorting," "opening," "leaky." *Cond. tester.* 11. Tuning condenser plates "peeling." *Examine; scrape, or burn out with high voltage.* 12. Condenser rotor-wiping fingers dirty or corroded. *Examine; clean; adjust.* 13. Trimmer or padder condenser insulation "defective." *Examine; ohmmeter test.* 14. Waveband switch contacts "dirty," "corroded," solder-splashed. *Examine; clean.* 15. Oscillator not functioning correctly (intermittent operation over a part of the dial). *Lower the value of the oscillator bias resistor.*	6. By-pass cond. "shorts," "leaky." *Cond. tester.* 7. Grid-return by-pass condensers in AVC circuits "open" or "leaky." *Condenser tester.* 8. Audio "coupling" or "isolating" cond. "shorting," "opening," or "leaky." *Condenser tester.* 9. Condenser rotor-wiping fingers "dirty" or "corroded." *Clean; adjust.* 10. Trimmer or padder condenser insulation "defective." *Examine; ohmmeter test.* 11. "Tuning" or "compensating" condenser rivets "loose." *Examine; tighten.* 12. Mounting screws on stator sections of gang condenser "loose." *Examine; tighten.* 13. Coil windings "snapped" at lugs of coils. *Examine; ohmmeter test.* 14. Coil-shield "grounding" contacts "corroded" or "loose." *Examine; clean; tighten.* 15. Grid leads "opening." *Examine; cont. test.* 16. "Local-distance" (or "sensitivity") switch or control-contacts "corroded." *Ohmmeter test.* 17. Waveband-switch contacts "dirty" or "corroded." *Examine; clean; adjust.* 18. Oscillator-tube bias resistor "too high." *Lower.*	6. By-pass cond. "shorted," "open," "leaky." *Check voltages; condenser tester.* 7. Grid-return condensers (AVC receivers) "open." *Condenser tester.* 8. Audio "coupling" or "isolating" cond. "shorted," "open," or "leaky." *Cond. tester.* 9. "Ant." post "grounded" to chassis. *Ohmmeter.* 10. R-F or i-f coil coil "open" or "shorted." *Ohmmeter test for proper resistance values.* 11. R-F, oscill., or i-f tuned stages "out of alignment." *Resonance check; follow realignment procedure.* 12. Condenser rotor-wiping fingers "dirty" or "corroded." *Examine; clean; adjust.* 13. Trimmer, padder, or neutralizing condenser insulation "defective." *Examine; ohmmeter test.* 14. Trimmer adjust screw "stripped." *New cond.* 15. Tuning belts "loose." *Tighten; apply rosin.* 16. Coil-switch contact points "dirty," "corroded," or "insufficient pressure." *Examine; clean; adjust.* 17. "Moisture" in r-f, oscillator, or i-f coils. *Check leakage between terminal lugs on coil form. Replace (or remove, bake, and moisture-proof them).*	3. R-F or i-f coil secondary (or grid lead) "open." *Check control-grid voltage; ohmmeter test.* 4. Grid lead "too close" to a-c filament or pilot-light lead ("tunable" hum). *Examine; re-route a-c leads.* 5. Bias resistor or by-pass condenser "shorted." *Check bias voltage; ohmmeter test; condenser tester.* 6. By-pass cond. of insufficient capacity ("tunable" hum). *Try condensers of larger capacity.* 7. Screen or cath-by-pass cond. "open." *Cond. tester.* 8. A-F transf. sec. winding (or grid lead) "open." *Check grid voltage; ohmmeter.* 9. Push-pull input trans. sec. "unbalanced." *Substitute.* 10. One section of push-pull output trans. primary "open." *Check plate voltages; ohmmeter test.* 11. Pilot-light "shorted." *Ohmmeter test.*	5. Tuned circuits "adjusted to tune too sharply." *Resonance test; readjust.* 6. Condenser rotor-wiping fingers "dirty" or "corroded." *Examine; clean; adjust.* 7. Tube or coil shields "not making good contact" with "chassis." *Examine; clean; tighten.* 8. R-F circuits "not neutralized." *Neutralize the receiver.* 9. "Open" circuit in neutralizing system. *Ohmmeter test.* 10. Grid-suppressor resistors "shorted." *Ohmmeter test.* 11. Grid leads "too close" to plate leads. *Examine; re-route wires.* 12. Condenser-can "grounding" contact surfaces "corroded" or "loose." *Examine; clean; tighten.* 13. Voltage-divider resistor "carbonized." *Check voltages; ohmmeter test.* 14. Plate or screen voltages "too high." *Check voltages; try reducing them.* 15. Plate, screen or cathode by-pass condenser "open." *Condenser tester.* 16. "Chassis grounds" poorly made. *Examine. Tighten or re-solder all suspicious connections.*	4. Tube or coil shields "not making good contact with chassis." *Examine; clean; tighten.* 5. Tube socket contacts "dirty" or "corroded." *Examine; clean; adjust.* 6. Grid leads "broken." *Examine; ohmmeter test.* 7. Carbon resistor "noisy." *"Noise test;" substitute.* 8. Wire-wound resistor "sparking." *Examine; ohmmeter test; substitute another resistor.* 9. Volume control resistor "noisy." *Examine; clean & adjust — or replace.* 10. By-pass or tone-control cond. "leaky." *Cond. tester.* 11. "Coupling" or "isolating" condenser in a-f amplifier "leaky." *Condenser tester.* 12. A-F transformer winding "noisy." *Substitute.* 13. "High-resistance (poorly soldered) connections — especially in the r-f and grid circuits, and chassis soldered "grounds." *Examine; tighten or resolder.* 14. Shielding of set-wiring "inadequate." *Examine.*	4. AVC resistors (where used) "open" or "changed value." *Check voltages; ohmmeter test.* 5. Audio stage grid resistor "open." *Check grid voltage; ohmmeter test.* 6. Voltage-divider resistors "carbonized" (or otherwise changed). *Check voltages; ohmmeter.* 7. Volume-control "defective." *Examine; ohmmeter.* 8. Bias-resistor by-pass condenser "shorted." *Check bias voltages; condenser tester.* 9. Audio "coupling" or "isolating" condenser "leaky" or "open." *Condenser tester.* 10. A-F transf. sec. "open." *Check grid volts; ohmmeter.* 11. Push-pull input transf. sec. "unbalanced." *Substitute.* 12. Pilot-light socket or wiring "shorting" to chassis. *Examine.* 13. "Rattling" at high volume. *Check chassis, tuning dial plate, etc. for loose screws.* 14. Output stage "overloading." *Check plate current of output tube for "distortion."*

Continued on next page

Rectifier and Filter Circuits (Cont'd)

1. Line plug "out," or "reversed" (d-c receiver). *Examine; reverse line plug.*
2. No power at line-supply receptacle—or receiver line cord "open." *Check voltages.*
3. Fuse "blown." *Examine fuse; check cont.*
4. Fuse "blows repeatedly." *Condenser tester for "shorted" buffer or filter condenser. Ohmmeter test for shorted power transformer winding.*
5. Ballast-lamp or line-resistor "open" (ac-dc receiver). *Check voltage, continuity.*
6. Rectifier tube "inoperative." *Tube checker, or substitution.*
7. Rectifier tube socket "fused," or contacts "loose." *Examine.*
8. Filter choke "open." *Check "B" voltage, continuity.*
9. "Filter" or "buffer" condenser "shorted." *Check "B" voltage; condenser tester.*
10. H.V. winding of power transformer "open" or "shorted." *Voltage test; ohmmeter test.*
11. Voltage-divider section "open," or terminal "grounded." *Check voltage; ohmmeter test.*
12. Bias resistor "open." *Check voltage, cont.*
13. Wires or terminal lugs "grounding" to chassis, connection "open" or "loose." *Examine; continuity test.*
14. Vibrator points "dirty" or "sticking" (batt. receiver). *Check "B" voltage; examine; substitute.*
15. Vibrator unit not in socket securely (battery receiver). *Check "B" voltage; examine.*

1. Line-plug contact "poor." *Examine; "wiggle" the line plug; adjust contacts.*
2. Fuse-clip contact "poor." *Examine; clean.*
3. Rectifier tube "defective." *Tube checker.*
4. Rectifier tube socket prong-contacts "poor." *Examine; clean; tighten.*
5. Filter condenser "shorts." *Check "B" voltage; condenser tester.*
6. Filter choke "opens." *Check voltage, continuity.*
7. Voltage-divider resistor section "opens." *Check voltage; continuity.*
8. Vibrator points "dirty" or "sticking" (in battery-operated receiver). *Check "B" voltage; examine; substitute new vibrator.*

1. "Poor contact" in line plug. *Examine; "wiggle" line plug while set fades; adjust contacts.*
2. Line voltage "fluctuates widely." *Check voltage at outlet during fading, with all house lights on and radio plugged in and turned "on."*
3. Fuse clip contacts "poor." *Examine; clean.*
4. Power-unit terminal strip nuts "loose." *Examine; tighten.*
5. Filter condenser "shorting." *Check "B" voltage; condenser tester.*
6. Filter or by-pass condenser "dried out," or "leaky." *Condenser capacity tester.*
7. Vibrator points "pitted" (in battery-operated receiver). *Check "B" voltage before and during "fading" period. Substitute new vibrator.*

1. Line voltage "too low." *Check line voltage with all house lights and receiver turned "on."*
2. Fuse clip contacts "poor." *Examine; clean.*
3. Rectifier tube "weak" or "gaseous." *Check "B" voltage; tube checker; substitute.*
4. Power-transformer winding "partially shorted." *Check voltages; ohmmeter test.*
5. Bias resistor "open." *Ohmmeter.*
6. Voltage-divider resistor "open," "carbonized," or "changed value." *Check voltages; ohmmeter test.*
7. Filter cond., "shorted" or "leaky." *Check voltage; condenser tester.*
8. "Low filament voltage" at tubes due to "loose nuts" on terminal strip. *Examine; check filament voltage at each tube socket; tighten nuts.*

1. Line hum. *Try reversing line plug.*
2. Line by-pass condenser "open" ("tunable" hum). *Condenser tester.*
3. Line by-pass condenser has "insufficient capacity" ("tunable" hum). *Substitute larger capacity.*
4. "Tunable" hum in ac-dc (Universal) receivers. *Connect a 0.2-mfd. condenser across power line, or from one side of the line to "ground." Connect a 0.1-mfd. mica condenser from each rectifier tube plate to rectifier filament.*
5. Buffer condenser across H.V. winding of power transformer "open." *Condenser tester.*
6. Rectifier tube "weak" or "defective." *Tube checker.*
7. Power transf. or filter-choke laminations "loose." *Examine; squeeze together; tighten clamps.*
8. Electrostatic shield of power transformer "ungrounded." *Examine; ohmmeter test.*
9. Inductive coupling between power transformer and receiver wiring. *Try moving transformer away, or turning it around 90 degrees.*
10. Filter condenser or its connections, "open" or otherwise faulty. *Condenser tester; continuity test.*
11. Filter choke resonating condenser "shorted" or "open." *Condenser tester.*
12. Insulated case of "can" type of condenser "grounded." *Ohmmeter test.*
13. Filter choke "shorted." *Check voltage; ohmmeter.*

1. Filter condenser "open" or "dried out" (lost capacity). *Capacity tester.*
2. Voltage-divider resistor "carbonized" or otherwise changed in value. *Ohmmeter test.*
3. Vibrator "defective" (battery receiver). *Check "B" voltage; substitute.*

1. "On-off" switch contacts "corroded" or "loose." *"Wiggle" the switch control — listen for noise.*
2. Fuse clips "corroded" or "loose." *Examine; clean.*
3. Line by-pass condenser "leaky." *Condenser tester.*
4. Power transf. H.V. winding "sparking-over" to shield. *Look for sparking in dark; substitute.*
5. Buffer condensers across H.V. winding "leaky" or "open." *Condenser tester.*
6. Rectifier tube "noisy." *"Tap" test; substitute.*
7. Rectifier tube socket "carbonized," or prongs "corroded" or "loose." *Clean; tighten; or replace.*
8. Filter or by-pass condenser punctured and "sparking-through." *Examine; condenser tester.*
9. Voltage-divider (or other carbon resistor) "porous" and sparking ("noisy"). *Make "noise test;" substitute.*
10. Voltage-divider resistor "open" and "sparking-over." *Ohmmeter test; substitute.*
11. High-voltage wires "sparking" to chassis. *Examine.*
12. Screws in housing of power supply unit (in batt. operated receiver) "loose." *Tighten all screws.*
13. Vibrator contacts "worn" (battery-operated receiver). *Examine; substitute new vibrator.*

1. Rectifier tube "weak." *Tube checker.*
2. Vibrator "defective" (battery receiver). *Check "B" voltage; substitute new vibrator.*
3. Filter condenser "open" or "dried out" (lost capacity). *Capacity tester.*
4. Bias resistor by-pass condenser "shorted." *Check bias voltages; condenser tester.*
5. Bias resistor "shorted" or "open." *Check bias voltages; ohmmeter test.*
6. Voltage-divider resistor "open" or "carbonized" (or otherwise changed.) *Check voltages; ohmmeter test.*

—Continued on next page—

TROUBLE-SHOOTING "REMINDER" CHART FOR COMMON "HOME-RADIO" RECEIVER TROUBLES—*(Cont'd)*

Possible Trouble Sources	*Symptoms of Trouble*							
	"Dead" Receiver	*Intermittent Reception*	*Fading*	*Weak*	*Excessive Hum*	*Oscillation*	*Noisy*	*Distortion & "Rattling"*
Rectifier and Filter Circuits *(Cont'd)*					14. Filter choke air-gap "too small." *"Short" out filter choke and note amount of hum increase.* 15. Vibrator unit "not securely in socket" (battery receiver). *Examine.* 16. Vibrator "defective" (battery receivers). *Check "B" voltage; substitute new unit.* 17. "Ground" between vibrator and chassis "imperfect" (batt. receivers). *Examine; ohmmeter.*			
Loud-Speaker	1. Loudspeaker "disconnected." *Examine.* 2. Voice (or humbuck) coil "open." *Ohmmeter.* 3. Output transformer prim. winding "open," or sec. winding "open" or "shorted." *Ohmmeter.* 4. Output choke "open" or "shorted." *Ohmmeter.* 5. Output cond. "open" or "shorted." *Cond. tester.*	1. Speaker plug making "poor contact" with socket. *Examine; "wiggle" plug while making continuity test; adjust contacts.* 2. "Loose connection" to voice coil, field coil, or output transformer. *Examine; ohmmeter test.* 3. Field coil or voice coil "shorting" or "opening." *Ohmmeter test.* 4. Voice coil "grounding" against pole-piece. *Examine for correct centering. Disconnect voice coil; check with ohmmeter from voice coil to pole-piece. Varnish voice coil; re-center.*	1. Speaker plug making "poor contact" with socket. *Examine; "wiggle" plug while making continuity test; adjust contacts.* 2. Field coil "shorting" or "opening." *Check voltages with radio turned "on;" ohmmeter.* 3. Voice coil "grounding" against pole-piece. *Examine for correct centering. Disconnect voice coil and check with ohmmeter from coil to pole-piece. Varnish, and re-center.* 4. Cone-apex "loose" ("magnetic" spk'r). *Tighten.* 5. Armature "sticks." *Examine. Free armature.*	1. Speaker plug contact "poor." *Examine; "wiggle" plug while making continuity test; adjust contacts.* 2. Speaker "out of adjustment." 3. No voltage supplied to field. *Check voltage.* 4. Field-supply rectifier "weak." *Check voltage output; tube checker.* 5. Field coil partially or fully "shorted," or "open." *Check voltages; ohmmeter test.* 6. Voice coil (or output transformer secondary) "partially shorted." *Ohmmeter.* 7. "High-resistance" connection somewhere. *Ohmmeter test.* 8. Magnet "weak" (permanent-magnet type speaker). *Substitute a similar "good" speaker, or check receiver output with earphones or an output meter.* 9. Speakers "out of phase" (multiple-speaker receivers). *Check "phasing." Reverse "either" the voice coil or the field coil connection on one of the speakers.*	1. Dry rectifier "needs replacement." *Check voltage output; replace.* 2. Hum-bucking coil "shorted." *Ohmmeter test.* 3. Hum-bucking coil "grounded" (in receivers having an ungrounded voice-coil circuit). *Ohmmeter test.* 4. Voice coil "rubbing against pole-piece." *Examine; re-center voice coil.* 5. One section of push-pull output transf. primary "open." *Check plate voltages; ohmmeter test.* 6. Filter condenser "open." *Condenser tester.*	1. "Audio howl" caused by loudspeaker leads being too close to chassis, or otherwise out of position. *Examine; separate speaker leads away from receiver chassis and all other wires.* 2. Field coil partially "shorted." *Check voltages; ohmmeter test.*	1. Iron filings or dirt between voice coil and pole-piece. *Examine; clean out.* 2. Voice coil "scraping" against pole-piece. *Check centering; re-center voice coil.* 3. Voice-coil wires "loose" (buzzing"). *Examine. Push. turns of coil carefully together and apply coil cement to hold them in place.* 4. Cone torn, worn, seam open, loose around edges, spider "broken." *Examine; repair or replace; re-center voice coil.* 5. Connection loose" or "poorly soldered." *Examine.* 6. Intermittent "open" in speaker cable wires. *Ohmmeter test while "jerking" cable wires.* 7. Mounting screws and nuts "loose." *Tighten.* 8. Armature of magnetic type speaker not "centered," driving rod "loose" or "snapped," cone apex "loose." *Examine; repair the part; re-center the armature.*	1. "Rattling" caused by "loose screws" in speaker. *Examine; tighten all screws.* 2. Iron filings or dirt between voice coil and pole-piece. *Examine; clean out.* 3. Voice coil "off-center," or armature of magnetic type speaker not "centered." *Examine; re-center.* 4. Voice-coil wires "loose" ("buzzing"). *Cement wires.* 5. Cone out of round, warped, torn, seam open, spider broken. *Examine; repair or replace; re-center voice coil.* 6. Speaker "overloaded," or not matched to output. *Check for distortion at low volume.* 7. Field coil energizing voltage "low." *Check voltage.* 8. Field rectifier "weak." *Check voltage output under load.* 9. Push-pull output transformer primary section "open." *Check plate voltages; ohmmeter test.*

—Continued on next page—

Miscellaneous	1. Receiver not turned "on." *Examine.* 2. Wrong type of current for receiver (ac instead of dc). *Voltmeter test.* 3. S.O.S. on air. *Try neighbor's set.* 4. Station not broadcasting *Try tuning over the entire range of dial.*	1. Interrupted power supply. *Check line-voltage with set plugged in and turned "on."* 2. Fault of broadcasting station. *Try tuning in different stations, or try another receiver.* 3. Natural "fading." *Try other stations, or another receiver.* 4. B-X electric light cables in house (usually in basement or cellar) not grounded properly, not clamped securely at outlet boxes, touch gas, water, or heating pipes. *Examine all B-X wiring carefully; tighten all B-X connectors, insulate from all pipes at cross-overs.*	1. Line voltage "fluctuates widely." *Check voltage at wall receptacle during fading (with all house lights on and receiver turned "on").* 2. "Natural fading" (due to atmospheric conditions). *Try other stations, or another receiver.* 3. B-X electric light cables in house (usually in basement or cellar) not grounded properly, not clamped securely at outlet boxes, touch gas, water, or heating pipes. *Examine all B-X wiring carefully, tighten B-X connectors, insulate from all pipes at cross-overs.*	1. Receiver sensitivity "too low" for location, or for permissible aerial installation. Check conditions; test with another set of known high sensitivity. 2. Line voltage "too low." *Check line voltage with all house lights and receiver turned "on."*	1. Lamp or electric clock on top of radio cabinet. *Examine; re-locate, or remove from radio.* 2. Hum from phonograph motor (in "phono - radio" combinations). *Notice if hum is present when operating receiver on "RADIO." "Ground" phono pickup arm and phonograph motor frame and chassis.* 3. Electrical apparatus operating nearby. *Notice if hum disappears when both aerial "lead-in" and "ground" wires are disconnected from receiver.* 4. Station modulation "poor." *Try tuning receiver to different stations.*	1. Two stations broadcasting at, or near, same frequency. *Try different station; make sure tuned circuits are aligned properly.* 2. "Oscillating receiver" nearby. *Try operating a midget radio receiver from the same aerial and ground.*	1. Audio "howl." *Be sure wooden chassis-spacer strips are removed, receiver shafts or knobs do not touch cabinet, and tuning condenser unit "floats" freely.* 2. "Loose" line fuses, lamp fixtures, electrical connections, electrical wiring in building. *Examine; clean; tighten all splices and connections.* 3. B-X electric light cables in house (usually in basement or cellar) not grounded properly, not clamped securely at outlet boxes, touch gas, water or heating pipes. *Examine all B-X wiring carefully, tighten all B-X connectors, insulate from all gas, water and heating pipes at cross-overs.* 4. Natural atmospheric "static." *Try a "midget" receiver connected to the same antenna system.* 5. Man-made "interference," due to electrical devices. *Track down source of interference.*	1. Owner does not tune receiver to "exact" resonance point. *Note tone when station is tuned in "exactly." Instruct owner in proper method of tuning, or install a tuning "meter" or "eye" where possible.* 2. Output stage or speaker "overloaded." *Operate at lower volume-control setting. Explain to owner.* 3. Two stations "interfering," or station modulation "poor." *Try other stations.*

END

TROUBLE-SHOOTING "REMINDER" CHART FOR COMMON "AUTO-RADIO" RECEIVER TROUBLES

Possible Trouble Sources	*Symptoms of Trouble*										
	"Dead" Receiver	*Intermittent Reception*	*Fading*	*Weak*	*Excessive Hum*	*Oscillation*	*Distortion & Rattling*	*"Noisy" (Both Car & Engine at rest)*	*"Noisy" (Car at Rest Engine Idling)*	*"Noisy" (When Car is driven normally)*	*"Noisy" (When Car coasts with ignition on)*
Antenna System	1. Lead-in "disconnected" at receiver. *Examine.* 2. Lead-in wire "open." *Ohmmeter test.* 3. Lead-in wire "shorting" to shield (or otherwise "grounded"). *Ohmmeter test.* 4. Joint at junction of lead-in and aerial "corroded," "loose," or "broken." *Examine; ohmmeter.* 5. Aerial "grounded" to car body. *Ohmmeter test.* 6. "Ant." terminal in receiver "grounded" to chassis. *Ohmmeter test.*	1. "Loose" or "corroded" connections and joints in antenna system — especially at junction of aerial and lead-in. *Examine; clean; tighten.* 2. Lead-in wire intermittently "shorting" to outer shielding. *Examine; continuity test.* 3. Aerial intermittently "grounding" to body of car. *Examine; continuity test while shaking aerial.* 4. Under-car type aerial "loose" and swinging up and down when car is running. *Examine for looseness; fasten in place rigidly.*	1. "Loose" or "corroded" connections and joints in antenna system — especially at junction of aerial and lead-in wire. *Examine; continuity test; clean; tighten.* 2. High-resistance "leakage" (or "grounding") between antenna and car body. *Ohmmeter test.* 3. "Poor" aerial system (having insufficient signal pickup when riding through radio "dead-spot"). *Test receiver with longer auxiliary aerial. Install a more efficient aerial system on the car.*	1. "Poor connections" in antenna system — especially at receiver lead, and at junction of lead-in and aerial. *Examine; clean; tighten.* 2. Antenna trimmer "out of adjustment." *Adjust for "max." volume with set connected to car antenna and weak station near 1500 kc tuned in.* 3. Capacity of "steel-top" aerial (Dodge car, etc.) "excessive." *Connect about a 0.00025-mfd. cond. in series with lead-in. Adjust "antenna trimmer."* 4. Capacity between lead-in wire and its shield "excessive." *Try auxiliary lead-in wire having thicker separating loom.* 5. Poor aerial system (either insufficient, or shielded too much by car body). *Try an "auxiliary" aerial. Install an aerial having greater signal pickup.*	1. "Hum" picked up from power lines along road. *Notice if hum stops when antenna is disconnected from receiver (with car and engine stopped). Try with car in a location away from all power lines.*	. . . . .	1. Signal-to-noise ratio "too low" "weak," "distorted" reception). *Try an auxiliary aerial. Install an aerial giving sufficiently high signal-to noise ratio.* 2. High-resistance "leakage" between antenna system and body of car. *Ohmmeter test.* 3. Lead-in wire shielding-braid "too close" to wire. *Use a shielded wire having a thicker separating loom.*	1. Test for antenna system "noise pickup" by disconnecting antenna system from radio while radio is "on," with car at rest and engine "idling." *If noise stops (or reduces), at least part of it is being picked up by the ant. syst. Then check following:* 2. Signal-noise ratio "too low." Install an aerial providing higher signal-noise ratio. 3. Lead-in wire shielding "too close" to wire. *Use wire with thicker separating loom.* 4. High-resistance "leakage" or "grounding" between antenna system and body of car. *Ohmmeter test.* 5. "Loose" or "corroded" connection at receiver "Ant." lead, or at junction of aerial and lead-in wires. *Examine; clean; tighten.* 6. "Intermittent break" in lead-in. *Ohmmeter test.*	1. Test for antenna system "noise pickup" by disconnecting antenna system from receiver while receiver is "on," with car being driven normally. *If the noise stops (or reduces), at least part of it is being picked up by the antenna system. Then check the following:* 2. A section of lead-in wire is "unshielded"—or the shielding is not "grounded" properly. *Examine; try "grounding" shield at various points (in some cases more quiet operation is secured by not grounding the shielding at all).* 3. Dome-light wires "radiating interference" into aerial or lead-in. *Disconnect dome-light wire at back of dash, and "ground" it to bulkhead. If this diminishes the noise, re-connect it as originally, but with a small r-f choke in series. By-pass wire to bulkhead (or car frame) with a 0.5-mfd. cond.*	1. First check for all troubles listed in "Car Parts & Wiring" section of this chart. Clear up any of these troubles present. If noise still persists, test for antenna system "noise pickup" by disconnecting antenna system from receiver while receiver is "on," with car "coasting" at 40 m.p.h. (ignition "off"). *If noise reduces, at least part of it comes from the antenna. Then check:* 2. Part of lead-in wire is "unshielded"—or the shielding is not "grounded" properly. *Examine; try "grounding" shield at various points (or not at all).* 3. Dome-light wires "radiating interference" into aerial or lead-in. *Disconnect dome-light wire at back of dash, and "ground" it to bulkhead. If this diminishes the noise, re-connect it as originally, but with a small r-f choke in series. By-pass wire to bulkhead (or car frame) with 0.5-mfd. cond.*
(Cont'd)											

—Continued on next page—

Antenna System *(Cont'd)*				6. High - resistance "leakage" between antenna system and body of car. *Ohmmeter test.* 7. Lead-in wire "open." *Ohmmeter test.*				7. Antenna "trimmer" out of adjustment. *Adjust for maximum volume with set in car and tuned to weak station around 1500 KC.*	4. In addition to foregoing, see troubles and tests listed in "Antenna System" section of the "Noisy" (both car and engine "at rest") column.	4. In addition to the foregoing see also all the troubles and tests listed in the "Antenna System" section of the "Noisy" (both car and engine "at rest") column.	4. In addition to the foregoing, see also all the troubles and tests listed in the "Antenna System" section of the "Noisy" (both car and engine "at rest") column.
Car Battery	1. Battery "weak." *Try self - starter, with radio & headlights "on." Hydrometer; recharge.* 2. Receiver "A" lead not making good contact with ammeter post (or batt. terminal). *Inspect; clean.* 3. Water level in battery "low." *Examine; refill.* 4. Connections to "A" line "reversed" (for receivers using "synchronous" type vibrator). *Examine; voltmeter test for battery polarity.*	1. Receiver "A" lead connection to ammeter post (or to car battery terminals) "loose" or "corroded." *Examine; clean; tighten.*	1. Battery "exhausted." Low or "nil" generator charging-current at low speeds insufficient to keep battery "bolstered" up, resulting in temporarily reduced battery voltage and receiver sensitivity (fading of signal at low car speeds). *Set plays loud when car is speeded up. Check water; charge.*	1. Battery "exhausted." *Hydrometer test; check voltage with radio and all car lights "on." Check water; clean terminals; charge batt.* 2. "Dead" cell. *Hydrometer test; check cell voltages.* 3. Receiver "A" - lead connection to ammeter post (or car battery) "corroded." *Examine; clean; tighten.*	1. Battery "weak" — or cell "defective." *Hydrometer test; check voltage with receiver "on" full.* 2. "Poor connections" to battery. *Examine; clean; tighten battery connections.* 3. Excessively long "A" lead. *Examine; shorten "A" lead.*	. . . . .	1. Battery "exhausted" (signals weak and distorted). *Hydrometer test; check voltage with radio "on."* 2. "A" lead from radio receiver to "A" line "too long." *Examine; re-route and shorten "A" lead.* 3. Connections to battery "corroded" (signals weak and distorted). *Examine; clean; tighten.*	1. Battery "exhausted" and "sulphated." *Hydrometer test; voltage test under load.* 2. Water level "low." *Examine; add distilled water.* 3. Terminals "corroded." *Examine; clean; tighten.*	1. Battery "exhausted" and "sulphated." *Hydrometer test; voltage test under load.* 2. Water level "low." *Examine; add distilled water.* 3. Terminals "corroded." *Examine; clean; tighten.*	1. Receiver "A" lead connection "loose" or "corroded." *Examine; clean; tighten.* 2. Main cable lug (or grounding strap lug) "loose" or "corroded" to batt. terminal. *Examine; clean.* 3. Battery "sulphated" and "exhausted." *Hydrometer test; voltage test under load; check water level.*	1. Receiver "A" lead connection "loose" or "corroded." *Examine; clean; tighten.* 2. Main cable lug (or grounding strap lug) "loose" or "corroded" to batt. terminal. *Examine; clean; tighten.* 3. Battery "sulphated" and "exhausted." *Hydrometer; voltage test under load; check water.*

—Continued on next page—

TROUBLE-SHOOTING "REMINDER" CHART FOR COMMON "AUTO-RADIO" RECEIVER TROUBLES—(Cont'd)

Possible Trouble Sources	Symptoms of Trouble: "Dead" Receiver	Intermittent Reception	Fading	Weak	Excessive Hum	Oscillation	Distortion & Rattling	"Noisy" (Both Car & Engine at rest)	"Noisy" (Car at Rest Engine Idling)	"Noisy" (When Car is driven normally)	"Noisy" (When Car coasts with ignition off)
Car Ignition System	.....	.....	.....	.....	.....	.....	.....	.....	1. Generator interference. Accelerate engine (with car at rest); then turn ignition switch "off." *A "whine" (decreasing in volume as engine dies down) indicates generator interference. Check generator bypass condenser for "open" or defect. Clean commutator and brushes.* 2. Test for interference from "primary" (L.T.) ignition circuit. *Disconnect the H.T. wire between ignition coil and distributor cap. Clamp engine hood down. Turn ignition switch "on" and turn engine over with a hand crank. "Clicks" in the receiver indicate "primary circuit" interference. No "clicks" indicate possible "secondary" circuit (H.T.) interference.* 3. If foregoing test reveals "primary (L.T.) circuit" interference: *Re-condition (or replace) and adjust breaker points. Check condenser across breaker points. Remove H.T. coil-to-dis-*	1. Generator interference. Accelerate engine (with car at rest); then turn ignition switch "off." *A "whine" (decreasing in volume as engine dies down) indicates generator interference. Check generator bypass condenser for "open" or defect. Clean commutator and brushes and undercut commutator mica (only if absolutely necessary).* 2. Test for interference from "primary" (L.T.) ignition circuit. *Disconnect the H.T. wire between ignition coil and distributor cap. Clamp engine hood down. Turn ignition switch "on" and turn engine over with a hand crank. "Clicks" in the receiver indicate "primary circuit" interference. No "clicks" indicate possible "secondary circuit" (H.T.) interference.* 3. If foregoing test reveals "primary (L.T.) circuit" interference: *Recondition (or replace) and adjust breaker points. Check con-*	1. If the receiver is "noisy" when the car is "coasting" with the ignition "off," it usually indicates loose connections in the electrical system of the car—or "wheel," "brake," or "tire" static. It is advisable to check for these troubles first (see "Car Parts and Wiring section). If noise clears up when remedies suggested there are applied but re-appears when car is operated normally with ignition "on," then the ignition system should also be suspected and checked as a noise source (see "Car Ignition System" section of "Noisy" (when car is driven normally) column.

(Cont'd)

—Continued on next page—

| | | |

TROUBLE-SHOOTING "REMINDER" CHART FOR COMMON "AUTO-RADIO" RECEIVER TROUBLES—(Cont'd)

Possible Trouble Sources	Symptoms of Trouble										
	Intermittent Reception	Fading	Weak	Excessive Hum	Oscillation	Distortion & Rattling	"Noisy" (Both Car & Engine at rest)	"Noisy" (Car at Rest Engine Idling)	"Noisy" (When Car is driven normally)	"Noisy" (When Car coasts with ignition off)
Car Parts & Wiring	.....	.....	.....	.....	.....	1. "Rattling" — especially at high volume levels. *"Rattles" seemingly in the radio receiver often are traced to loose parts (such as instruments, wires, control rods, tubes, cables, etc.) on the bulkhead or instrument panel of the car. Try grasping any suspected member tightly in your hand when the "rattling" occurs. If this stops the rattle, strap this member securely in place (or do whatever else is necessary to prevent its vibration).*	.....	1. Dome-light wires "radiating interference" into aerial or lead-in. *Disconnect dome-light wire at back of dash. "Ground" it to bulkhead. If this diminishes noise, re-connect it as originally, but with a small r-f choke in series. By-pass wire to bulkhead with 0.5 mfd. cond.* 2. Headlight, stop-light, tail-lights, horn, electric clock, heater, defroster, etc., wiring "radiating interference" into antenna (especially with under-car type aerial). *Try by-passing each with a 0.5- or 1.0-mfd. cond. from "hot" side directly to chassis.* 3. Speedometer cable, oil lines, choke wires, free-wheeling cables, control rods, electric gauge lines, heaters, windshield-wiper pipe, steering post, radiator, motor block, muffler, exhaust pipe, engine hood, bulkhead, instrument panel, etc., not properly "grounded" to car. *Make sure each is properly "grounded."*	1. "Loose connections" in electrical system of car. *Check for noise with all lights and electrical accessories turned "off," then turn "on" one at a time and note noise. Examine and check all light-bulb contacts and all lighting and "accessory" wiring for loose connections.* 2. "Wheel" or "Brake" static, and "Tire" static. *See tests and remedies for "Wheel" or "Brake" static, and "Tire" static, listed in the "Car Parts & Wiring" section of the "Noisy" (car coasting with ignition "off") card.* 3. Nail in tire. *Examine tires; remove imbedded metal.* 4. Tires "over-" or "under-inflated." *Examine; inflate to proper pressure.* 5. See also the three items in "Car Parts & Wiring" section of "Noisy" (car at rest with engine idling) column.	1. "Loose connections" in electrical system of car. *Check for noise with all lights and electrical accessories turned "off," then "on." Examine, and check all light-bulb contacts and all lighting and "accessory" wiring for loose connections.* 2. "Wheel" or "brake" static. (It is assumed that the receiver is "quiet" with car at rest and engine idling, but "noisy" with ignition "off" and car "coasting" at 40 m.p.h.). *Get car coasting at 40 m.p.h. with ignition "off" and clutch disengaged. Apply foot brake. If noise stops, source of static is in wheels or brakes. Use graphite grease in front wheel bearings, or "grounding" springs in hub caps. "Ground" rear wheels by removing them and placing 2 turns of heavy spring brass wire to make continuous contact between stationary brake housing and moving wheel. Metal "slivers" protruding from brake lining, and loose metal brake lining rivets, may also cause "wheel static." Remove wheels, inspect brake linings. Trim down all slivers, and tighten all loose rivets. In cars with external brakes, it may be necessary to "ground" the brake bands to car frame.* 3. "Tire" static (receiver "quiet" with car at rest and engine idling, but "noisy" with ignition "off" and car coasting at 40 m.p.h.). *Make same test as for "wheel" static. If noise does not stop (or greatly diminish) when brake is applied, it is probably "tire" static. Check tires for under- or over-inflation. Inspect carefully for nails or other metallic objects embedded in casings, as these will cause "tire" static. If not cleared up, remove tires from wheels and examine interiors carefully for a dull grey area about 3 x 18 inches. This is cement for balancing wheel. Remove this.*

Tubes	1. Grid cap and tube shield "shorting" to each other (touching). *Examine.* 2. High "contact resistance" at grid prong or cap of oscillator tube. *Clean & tighten.* 3. Tube "shaken out of socket." *Examine.* 4. Tube "burned out," or elements "shorted." *Tube checker.* 5. Oscillator tube "flat" (not oscillating). *Substitute.* 6. Tube prong contacts "faulty." *Examine.*	1. Tube "not seated properly" in socket. *Examine.* 2. Tube shields "shorting" to control-grid caps or leads. *Examine.* 3. "Imperfect contacts" at tube prongs or grid caps. *Examine; clean; tighten.* 4. Tube elements "loose" or "shorting." *"Tap" test; tube checker.* 5. Tube heater "open-circuiting" intermittently. *Examine for light while receiver goes dead; tube checker.* 6. "Flat" oscillator tube tube not oscillating properly). *Substitution.*	1. Grid caps or clips "corroded," or "loose." *Examine; clean; tighten.* 2. Tube "not seated in socket" firmly. *Examine.* 3. "Corroded" or "loose" contacts between tube shields and bases or chassis. *Clean; tighten.* 4. Tube elements "loose" or "shorting." *"Tap" test; tube checker.* 5. Tubes "weak." *Tube checker.* 6. Heater of tube "open-circuiting" intermittently. *Examine for light while receiver fades"; tube checker.* 7. Poor "oscillator" or "AVC" tube. *Substitute.* 8. "Imperfect" contacts at tube prongs. *Examine; clean; tighten.*	1. "High-resistance" contact at grid prongs or caps (especially at oscillator tube). *Examine; clean; tighten.* 2. "Corroded" or "loose" contacts between tube shields and bases or chassis. *Examine; clean.* 3. Shields "grounding" to grid caps. *Examine.* 4. "Imperfect contacts" at tube prongs. *Examine; clean; tighten.* 5. Weak or "gassy" tubes. *Tube checker.* 6. Cathode-heater leakage. *Tube checker.* 7. "Flat" oscillator tube (does not oscillate). *Substitute a new tube.* 8. "Wrong type" tubes for receivers. *Examine; check "type" numbers.*	1. Rectifier tube "weak" or "defective." *Tube checker.* 2. Cathode-heater "leakage." *Check all tubes with tube checker.* 3. "Shorted" element in ht'r-type tube. *Tube checker.* 4. Push-pull power tubes "unmatched." *Tube checker.*	1. Tube shields not making good contact with "chassis." *Examine; clean; tighten.* 2. "Wrong type" tubes. *Examine; check "type" numbers.* 3. "Gassy," "high-emission" tubes. *Tube checker.*	1. "Wrong type" tubes. *Check "type" numbers.* 2. "Rattling" caused by "loose" tube shields. *Examine; tighten.* 3. "Microphonic" or "shorting" elements in tubes. *"Tap" test.* 4. Tube prongs "dirty" or "corroded." *Examine; clean; adjust.* 5. "Gassy," "high-emission" tubes. *Tube checker.* 6. Tubes "weak" (especially power tubes). *Tube checker.* 7. Cathode-heater "leakage." *Tube checker.* 8. Detector tube needs "replacement." *Tube checker.* 9. AVC tube needs "replacement." *Substitute.* 10. Output push-pull tubes mis-matched. *Tube checker.*	1. Contacts at tube socket prongs or grid caps "loose" or "corroded." *Examine; clean; tighten.* 2. Tube shields not making firm contact with chassis. *Examine; clean; tighten.* 3. Tubes "noisy." *"Tap" test.* 4. Tubes "weak." *Tube checker.* 5. Tube elements "shorting." *Tube checker.* 6. Cathode-heater "leakage." *Tube checker.*	1. Tube shields not making firm contact with chassis. *Examine; clean; tighten.* 2. Tubes "noisy." *"Tap" test.* 3. Contacts at tube socket prongs or grid caps, "loose" or "corroded." *Examine; clean; tighten.* 4. Tubes "weak." *Tube checker.* 5. Tube elements "shorting." *Tube checker.* 6. Cathode-heater "leakage." *Tube checker.*	1. Tube shields not making firm contact with chassis. *Examine; clean; tighten.* 2. Tubes "noisy." *"Tap" test.* 3. Contacts at tube socket prongs or grid caps "loose" or "corroded." *Examine; clean; tighten.* 4. Tubes "weak." *Tube checker.* 5. Tube elements "shorting." *Tube checker.* 6. Cathode-heater "leakage." *Tube checker.*	1. Tube shields not making firm contact with chassis. *Examine; clean; tighten.* 2. Tubes "noisy." *"Tap" test.* 3. Contacts at tube socket prongs or grid caps "loose" or "corroded." *Examine; clean; tighten.* 4. Tubes "weak." *Tube checker.* 5. Tube elements "shorting." *Tube checker.* 6. Cathode-heater "leakage." *Tube checker.*

—Continued on next page—

TROUBLE-SHOOTING "REMINDER" CHART FOR COMMON "AUTO-RADIO" RECEIVER TROUBLES—*(Cont'd)*

Possible Trouble Sources	*Symptoms of Trouble*										
	"Dead" Receiver	*Intermittent Reception*	*Fading*	*Weak*	*Excessive Hum*	*Oscillation*	*Distortion & Rattling*	*"Noisy" (Both Car & Engine at rest)*	*"Noisy" (Car at Rest Engine Idling)*	*"Noisy" (When Car is driven normally)*	*"Noisy" (When Car coasts with ignition off)*
Receiver Circuits Proper	1. "On - off" switch "defective." *"Wiggle" switch control while checking voltages at switch.* 2. Voltage-divider resistor section "open." *Check voltage; continuity.* 3. Plate or grid resistor "open." *Check plate & grid voltages; continuity & ohmmeter test.* 4. A-F transformer prim. or sec. "open." *Check plate & grid voltages; continuity.* 5. Bias resistor "open" or "shorted." *Check voltage; ohmmeter test.* 6. "Coupling" or "isolat." cond. in a-f amplif. "shorted" or "open." *Cond. tester.*	1. "On - off" switch "defective." *"Wiggle" switch control while checking voltages at switch.* 2. Voltage - divider (or other resistor) "open-circuiting." *Voltage check; ohmmeter.* 3. Resistors "shorting" to one another or to chassis. *Examine.* 4. Leads "shorting" to chassis (insulation cut by sharp edges of holes in chassis where wires run through). *Examine.* 5. Contacts or soldered connections "loose." *Examine; tighten or re-solder.* 6. By-pass condenser "shorting" intermittently, or "leaky." *Condenser tester.*	1. "On - off" switch "defective." *Examine; "wiggle" the switch - control while checking "A" voltage "ahead" and "after" switch.* 2. Resistors "shorting" to one another, or "grounding" to chassis. *Examine.* 3. Voltage - divider or bias resistors "changed value." *Check voltages; ohmmeter test.* 4. Condenser rotor - wiping fingers "dirty" or "corroded." *Examine; clean; adjust.* 5. Tuning condenser gang rotors "loose" (changing the tuning). *Examine; adjust and tighten bearing.*	1. "On - off" switch "defective." *Examine; "wiggle" switch control while checking "A" - voltage "ahead" and "after" switch.* 2. Grid or plate resistor "open" or "grounded." *Check voltages; ohmmeter test.* 3. Voltage divider resistors "changed value." *Check voltages; ohmmeter test.* 4. Bias resistor "open" or "changed value." *Check bias voltages; ohmmeter test.* 5. Audio "coupling" or "isolating" cond. "shorted," "open," or "leaky." *Condenser tester.* 6. Push - pull input transformer secondary section "open." *Check grid voltages; ohmmeter test.* 7. By-pass condenser "shorted," "open," or "leaky." *Check voltages; condenser tester.* 8. Ant. connector partially "grounded." *Ohmmeter.*	1. R-F or i-f coil secondary (or grid lead) "open." *Check control - grid voltage; ohmmeter test.* 2. Bias resistor "shorted." *Check bias voltages; ohmmeter test.* 3. By-pass condenser *Check bias voltages; condenser tester.* 4. By-pass condenser of "insufficient capacity" — ("tunable" hum). *Try condensers of larger capacity.* 5. Screen or cathode by-pass condenser "open." *Condenser tester.* 6. A-F trans. sec. winding "open." *Check grid voltage; ohmmeter.*	1. Audio oscillation ("howl"). Tuning condenser not floating freely in rubber mountings. *Free it.* 2. "Wrong tube" in socket. *Check "type" numbers.* 3. Tuned circuits "not aligned properly." *Resonance test; follow alignment procedure.* 4. Tuned circuits adjusted to tune too sharply. *Resonance test; re-adjust.* 5. Condenser rotor - wiping fingers "dirty" or "corroded." *Examine; clean; adjust.* 6 Tube or coil shields "not making good contact" with "chassis." *Examine; clean; tighten.* 7. Condenser can "grounding," contact surfaces "corroded" or "loose." *Examine; clean; tighten.*	1. "Wrong tube" in socket. *Check "type" numbers.* 2. Bias resistor "shorted," "open" or "too high." *Check bias voltages; ohmmeter test.* 3. AVC resistors "open" or "changed value." *Check voltages; ohmmeter test.* 4. Audio - stage grid resistor "open." *Check grid-voltage; ohmmeter test.* 5. Voltage - divider resistors "carbonized" (or otherwise changed in value). *Check voltages; check resistances with ohmmeter.* 6. Volume - control resistor "defective." *Examine, ohmmeter test.*	1. "On - off" switch defective. *Examine; "wiggle" switch-control and listen for noise.* 2. Tuning condenser plates "burred," "peeling" or "shorting." *Examine; clean; adjust.* 3. Tuning condenser rotor-wiping fingers "dirty" or "corroded." *Examine; clean; just.* 4. Tube or coil shields "not making good contact with" chassis. *Examine; clean; tighten.* 5. Tube socket contacts "dirty" or "corroded." *Examine; clean; adjust.* 6. Grid leads broken. *Examine; ohmmeter test.* 7. Carbon resistor "noisy." *Make "noise test" — or substitute another resistor.*	1. Receiver case "imperfectly grounded" to bulkhead of car. *Examine; clean bulkhead around mounting holes with stiff wire brush. Tighten mt'g. bolts. Tighten mt'g. bolts.* 2. Remote - control cables "imperfectly grounded" to car. *Examine; clean all "grounding" contact surfaces; tighten all clamps.*	1. Receiver case "imperfectly grounded" to bulkhead of car. *Examine; clean bulkhead around mounting holes with stiff wire brush. Tighten mounting bolts.* 2. Remote - control cables "imperfectly grounded" to car. *Examine; clean all "grounding" contact surfaces; tighten all clamps.*	1. Receiver case "imperfectly grounded" to bulkhead of car. *Examine; clean bulkhead around mounting holes with stiff wire brush. Tighten set-mounting bolts.* 2. Remote - control cables "imperfectly grounded" to car. *Examine; clean all "grounding" contact surfaces.*
(Cont'd)											

—Continued on next page—

Receiver Circuits Proper *(Cont'd)*

7. By-pass cond. "shorted." *Condenser tester.*
8. R-F, i-f, or oscillator coil "open." *Check voltage; continuity.*
9. Wire or connection "broken." *Examine.*
10. Insulation "broken," wire "grounding" to chassis. *Examine; continuity test.*
11. Grid - return condenser in r-f or i-f circuits "open." *Condenser tester.*
12. Gang condenser section, trimmer, or padder "shorted." *Continuity test.*
13. Antenna conductor unit "shorted" to chassis. *Ohmmeter test.*

7. Audio coupling," or "isolating" cond. "shorting," "opening," or "leaky." *Cond. tester.*
8. Leads "shorting" together (especially in cabled wiring). *Continuity test between leads.*
9. Condenser rotor - wiping fingers "dirty" or "corroded." *Examine; clean; adjust.*
10. Trimmer or padder condenser insulation "defective." *Examine; ohmmeter test.*
11. Oscillator not functioning properly (intermittent operation ov operation over part of dial). *Lower the value of the oscillator bias resistor.*

6. "Corroded" or "loose" contacts between coil shields and chassis. *Examine; clean; tighten.*
7. By-pass condenser "shorting" or "leaky." *Condenser tester.*
8. Audio "coupling" or "isolating" cond. "shorting," "opening," or "leaky." *Cond. tester.*
9. Grid - return by-pass condensers in AVC system "open," or "leaky." *Condenser tester.*
10. Oscillator tube bias-resistor "too high." *Replace with one of lower resistance.*
11. Resistors in AVC system "open." *Check voltages; ohmmeter test.*
12. Trimmer or padder condenser insulation "defective." *Examine; ohmmeter test.*
13. Compensating and "padding" condenser screws "loose." *Examine; tighten.*
14. "High - resistance" leaks. *Ohmmeter test.*
15. "Moisture" in r-f or i-f coils. *Resonance test; substitution; or remove and bake coils in even, then moisture proof them.*

9. AVC circuit trouble. *Check all resistors and condensers in AVC circuit.*
10. Broken wire, connection, or loosely-soldered joint. *Examine; repair.*
11. R-F, oscillator, or i-f tuned stages "out of alignment. *Resonance check; realignment procedure.*
12. Condenser rotor - wiping fingers "dirty" or "corroded." *Examine; clean; adjust.*
13. Trimmer condenser adjusting-screw "stripped." *Examine; replace condenser.*
14. Trimmer, padder, or neutralizing condenser insulation "defective." *Examine; ohmmeter test.*
15. R-F or i-f coil "open" or "shorted." *Ohmmeter test for proper resistance values.*
16. I-F transformer gain reduced by "softening of wax" and "shifting of iron coupling core." *Examine; substitute new coil; realign receiver.*
17. "Moisture" in r-f, oscillator, or i-f coils. *Check leakage between terminal lugs on coil form. Replace coils, or remove them and bake out in oven. Moisture - proof them.*

7. Push - pull input transformer secondary "unbalanced." *Substitute.*
8. One section of push-pull output transformer primary "open." *Check plate voltages; ohmmeter test.*
9. "A" leads "excessively long." *Examine; run "A" leads more directly and shorter.*
10. "High - resistance" joints in the hot "A" or "ground" circuits of the receiver. *Examine; secure perfect grounding at the radio set mounting bolts, and try connecting "A" supply lead directly to "starter switch."*

8. Grid leads "too close to plate leads." *Examine; re-route wires.*
9. Voltage - divider resistor "carbonized." *Check voltages; ohmmeter test.*
10. Plate or screen voltages "too high." *Check voltages; try reducing them.*
11. Plate, screen or cathode by-pass condenser "open." *Condenser tester.*
12. "Chassis grounds" poorly made. *Examine; Tighten or re-solder all solder all suspicious connections*
13. Chassis of receiver improperly (or insufficiently) shielded. *Examine for loose screws and corroded contact surfaces in chassis and shielding; tighten all screws holding receiver chassis to case.*

7. A-F transformer secondary "open." *Check grid voltage; ohmmeter test.*
8. Bias - resistor by-pass condenser "shorted." *Check bias voltages; condenser tester.*
9. Audio "coupling" or "isolating" condenser "leaky" or "open." *Condenser tester.*
10. Push-pull input transformer secondary "unbalanced." *Substitute a new transformer.*
11. "Rattling" at high volume. *Check receiver for loose cover screws, chassis - fastening screws, etc.*
12. Output stage "overloading." *Chassis plate current of output tube for "distortion."*

8. Wire - wound resistor "sparking." *Examine; ohmmeter test; substitute another resistor.*
9. Volume - control resistor "noisy." *Examine; clean and adjust—or replace.*
10. By-pass cond. "leaky" or "noisy." *Condenser tester.*
11. "Coupling" or "isolating" condenser in a-f amplifier "leaky." *Condenser tester.*
12. A-F transformer winding "noisy." *Substitute.*
13. "High - resistance" or "poorly soldered" connections — especially in the r-f circuits, grid connections, and chassis-soldered "grounds." Examine; *Examine; tighten or re-solder.*

3. Chassis shielding "imperfect" (large vent holes in receiver case). *Examine; previous experience; possibly install different type receiver.*
4. In addition to the foregoing, see all troubles and tests in the "Receiver Circuits Proper" section of the "Noisy" (both car and engine engine "at rest") column.

3. Chassis shielding "imperfect" (large vent holes in receiver case). *Examine; possibly install different type receiver.*
4. Junction boxes poorly "grounded." *"Ground" properly.*
5. In addition to the foregoing, see also all troubles and tests in the "Receiver Circuits Proper" section of the "Noisy" (both car and engine "at rest") column.

3. Chassis shielding "imperfect" (large vent holes in receiver case). *Examine; possibly install different type receiver.*
4. In addition to the foregoing, see also all the troubles and tests in the "Receiver Circuits Proper" section of the "Noisy" (both car and engine "at rest") column.

—Continued on next page—

TROUBLE-SHOOTING "REMINDER" CHART FOR COMMON "AUTO-RADIO" RECEIVER TROUBLES—(Cont'd)

Possible Trouble Sources	Symptoms of Trouble: "Dead" Receiver	Intermittent Reception	Fading	Weak	Excessive Hum	Oscillation	Distortion & Rattling	"Noisy" (Both Car & Engine at rest)	"Noisy" (Car at Rest Engine Idling)	"Noisy" (When Car is driven normally)	"Noisy" (When Car coasts with ignition off)
Rectifier and Filter Circuits (Cont'd)	1. Fuse blown. *Examine fuse; continuity.* 2. Fuse "blows repeatedly." *Inspect for "shorting" wires; substitute new vibrator.* 3. Vibrator "defective" (sticking). *Examine; substitute new vibrator.* 4. Vibrator "not in socket securely." *Examine.* 5. Power unit connecting block contacts "imperfect." *Continuity.* 6. Rectifier tube "inoperative." *Tube checker.* 7. Rectifier socket "fused." *Examine.* 8. Filter choke "open." *Check "B" voltage.* 9. Filter or buffer cond. "shorted." *Check "B" voltage; continuity test on condensers.* 10. H.V. winding of power transf. "shorted" or "open." *Voltage test; ohmmeter test.* 11. Voltage - divider section "open," or terminal "grounded." *Check voltage; ohmmeter test.* 12. Bias resistor "open." *Check bias, continuity.*	1. Fuse clip contacts "poor." *Examine; clean.* 2. Vibrator "defective." *Check "B" voltage; substitute new vibrator.* 3. Wire "broken" inside vibrator case. *Examine; continuity test.* 4. Rectifier tube "defective." *Tube checker; substitute new tube.* 5. Rectifier tube socket contacts "poor." *Examine; clean; tighten.* 6. Buffer cond. across H.V. winding of pow. transf. "opens." *Check "B" voltage; condenser tester.* 7. Filter condensers "leaky" or intermittently "shorted." *Check "B" voltage; cond. tester.* 8. Filter choke "opens." *Check voltage.*	1. "A" voltage "drops." *Check when set "fades." See "Car Battery" section of this chart.* 2. Vibrator points "pitted." *Examine; check "B" voltage; substitute new vibrator.* 3. Filter or by-pass condenser "dried out or leaky." *Condenser capacity tester.* 4. Buffer cond. across H.V. winding of power transf. "opens." *Condenser tester; continuity.*	1. Fuse contacts "corroded." *Examine; clean.* 2. Car - battery voltage "low." *Hydrometer test; check voltage at radio (with radio "on").* 3. Rectifier tube "weak" or "gaseous" (filament type). *Check "B" voltage; tube checker.* 4. Rectifier tube "weak" or "exhausted" (gaseous type). *Check "B" voltage; substitute new tube.* 5. Vibrator "defective." *Check "B" voltage; substitute new tube.* 5. Vibrator "defective." *Check "B" voltage.* 6. Buffer cond. across H.V. winding of power transformer partially "shorted." *Condenser tester; continuity test.* 7. Filter cond. "leaky" or partially "shorted." *Condenser tester.* 8. Filter cond. "open" or "dried out." *Capacity tester.* 9. Voltage - divider resistor "open" or "changed value." *Check voltage; ohmmeter test.*	1. Filter condenser "open" or "dried out." *Capacity tester.* Buffer condenser across H.V. winding of power transformer "open." *Condenser tester. Replace with condenser of exactly same capacity.* 3. Vibrator "defective." *Substitute.* 4. "Ground" between vibrator and chassis imperfect. *Examine; ohmmeter.* 5. Lead inside of vibrator housing "broken." *Examine; ohmmeter test.* 6. Rectifier tube "weak" or "defective." *Tube checker.* 7. Power transf. or filter choke laminations "loose." *Examine; squeeze together; tighten clamps.* 8. Filter choke "shorted." *Check voltage; ohmmeter.* 9. By-pass condenser "open." *Condenser tester.*	1. Filter condenser "open" or "dried out" (lost capacity). *Capacity tester.* 2. Voltage - divider resistor "carbonized" or otherwise "changed in value." *Ohmmeter test.* 3. Vibrator "defective." *Check "B" voltage; substitute.*	1. Rectifier tube "weak" *Tube checker; substitute.* 2. Rectifier socket "carbonized." *Examine; replace.* 3. Vibrator "defective." *Check "B" voltages; substitute.* 4. Filter condenser "open" or "dried out" (lost capacity). *Capacity tester.* 5. Bias resistor by-pass condenser "shorted." *Check bias voltages; condenser tester.* 6. Bias resistor "shorted" or "open." *Check bias voltages; ohmmeter test.* 7. Voltage - divider resistors "carbonized" (or otherwise changed). *Check voltages; ohmmeter.* 8. Voltage - divider resistor "open." *Check voltages; ohmmeter test.*	1. Fuse clips "corroded" or "loose." *Examine; clean; tighten.* 2. Vibrator contacts "worn." *Examine; substitute.* 3. Buffer condenser across H.V. secondary of power transf. "leaky" or "open." *Condenser tester.* 4. Condenser in r-f "hash-filter" of vibrator "open." *Condenser tester.* 5. Rectifier tube "noisy." *"Tap" test; substitute.* 6. Rectifier socket "carbonized." *Examine; replace.* 7. Filter or by-pass condenser "punctured" and "sparking-through." *Examine; condenser tester.* 8. Voltage - divider (or other carbon resistor) "porous" and sparking ("noisy"). *Make "noise test" — or substitute new resistor.* 9. Voltage - divider resistor "open" and "sparking - over." *Ohmmeter test; substitute new resistor.* 10. High - voltage wires too close to chassis, and	1. "A" - filter choke "shorted" or "defective." *Ohmmeter test; substitute.* 2. "A" bypass condenser "open." *Condenser tester.* 3. "Eliminode" not adjusted properly. *Examine; adjust correctly in accordance with mnfr's. instructions.* 4. In addition to the foregoing, see also all troubles and tests listed in the "Power Unit" section of the "Noisy" (both car and engine "at rest") column.	1. "A" - filter choke "shorted" or "defective." *Ohmmeter test; substitute.* 2. "A" by-pass condenser "open." *Condenser tester.* 3. "Eliminode" not adjusted properly. *Examine; adjust correctly according to manufacturer's instructions.* 4. In addition to the foregoing, see also all the troubles and tests listed in the "Power Unit" section of the "Noisy" (both car and engine "at rest") column.	1. "A" - filter choke "shorted" or "defective." *Ohmmeter test; substitute.* 2. "A" by-pass condenser "open." *Condenser tester.* 3. In addition to the foregoing, see also all the troubles and tests listed in the "Power Unit" section of the "Noisy" (both car and engine "at rest") column.

—Continued on next page—

Rectifier and Filter Circuits *(Cont'd)*	13. "A" choke "open." *Check "A" voltage.* 14. Wires or terminal lugs "grounding" to chassis. *Examine; continuity test.* 15. Leads "loose," "broken." *Examine; continuity.*			10. Bias resistor "open." Check bias voltages; *ohmmeter test.*				"sparking." to it. *Examine.* 11. "A" lead too long, causing excessive drop in "A" voltage. *Check "A" voltage at receiver (with receiver turned "on" full).* 12. Screws in housing of power supply unit "loose." *Tighten all screws securely.*		
Loud-Speaker	1. Loudspeaker "disconnected." *Examine.* 2. Voice coil "open," or "shorted." *Ohmmeter test.* 3. Output trans. prim. "open," or sec. "open" or "shorted." *Ohmmeter test.* 4. "Broken" wire in loudspeaker cable. *Continuity test.* 5. "Imperfect contact" in speaker plug. "*Wiggle*" *plug while checking continuity.*	1. Speaker plug making poor contact. *Examine; "wiggle" plug while checking continuity.* 2. Connection to voice coil, field coil, or output transf.; "loose." *Examine.* 3. Field coil "shorting," or "opening." *Check voltages with receiver turned "on"; ohmmeter test.* 4. Voice coil "grounding" against pole-piece. *Examine for correct "centering." Disconnect voice coil and test with ohmmeter from voice coil to pole-piece. Varnish voice coil, and recenter.*	1. Speaker plug "making poor contact." *Examine; "wiggle" plug while checking continuity.* 2. Field coil "shorting" or "opening." *Check voltages; ohmmeter test.* 3. Voice coil "grounding" against pole-piece. *Examine for correct centering. Disconnect voice coil and test with ohmmeter from voice coil to pole-piece. Varnish coil and re-center.*	1. Speaker plug making poor contact. *Examine; wiggle plug while checking continuity; adjust.* 2. Speaker "out of adjustment." *Examine; readjust.* 3. Field coil "open" or "shorted." *Check voltage; ohmmeter test.* 4. Voice coil (or output transformer secondary) partially "shorted." *Ohmmeter test.* 5. Magnet "weak" (permanent-magnet type speaker). *Substitute a similar "good" speaker, or check receiver output with earphones or an output meter.*	1. Voice coil "rubbing against pole-piece." *Examine; re-center voice coil.* 2. One section of push-pull output transf. primary "open." *Check plate voltages.*	1. Voice-coil insulation "scraped off," and wires scraping against pole-piece. *Ohmmeter; examine.* 2. Field coil partially "shorted." *Check voltages; ohmmeter test.* 3. "Audio howl" caused by loudspeaker leads being too close to chassis, or otherwise out of position. *Examine; separate speaker leads away from receiver chassis and all other wires.*	1. "Rattling" caused by "loose" screws in speaker, or speaker case. *Examine; tighten all screws* 2. Iron filings or dirt between voice coil and pole piece. *Examine; clean out.* 3. Voice coil "off-center." *Examine; re-center.* 4. Armature of magnetic type speaker "not centered." *Examine; re-center.* 5. Voice-coil wires "loose" ("buzzing" sound). *Examine. Push turns of coil carefully together and apply thin coat of coil cement to hold them in place.* 6. Cone spider "broken" (detected by distortion at low volume). *Examine; voice-coil centering test.* 7. Cone out of round, warped, torn, seam open, too soft, too stiff.	1. Iron filings or dirt between voice coil and pole-piece. *Examine; clean out.* 2. Voice coil "scraping" against pole-piece. *Check centering; re-center voice coil.* 3. Voice-coil wires "loose" ("buzzing" sound). *Examine. Push turns of coil carefully together and apply a thin coat of coil cement to hold them in place.* 4. Cone spider "broken." *Examine; check voice-coil centering.* 5. Cone torn, worn, seam open, loose around the edges. *Examine. Repair, or replace cone.* 6. Connection "loose" or "poorly soldered." *Examine.* 7. Intermittent "open" in speaker cable wires. *Ohmmeter test while "jerking" cable wires.*	1. Loudspeaker cable shielding "grounded" imperfectly to car. *Examine; provide good "grounding."* 2. Iron filings or dirt between voice coil and pole piece. *Examine; clean out.* 3. Voice coil "scraping" against pole piece. *Check centering; re-center voice coil.* 4. Voice coil wires "loose" ("buzzing" sound). *Examine. Push turns of coil carefully together and apply a thin coat of coil cement to hold them in place.* 5. Cone spider "cracked" or "broken." *Examine; check the voice-coil for proper "centering."* 6. Cone torn, worn, seam open, loose around edges. *Examine; repair or replace.* 7. Connection "loose" or "poorly soldered." *Examine.*	1. Loudspeaker "mounted loosely." *Examine; tighten.* 2. Connection "loose" or "poorly soldered." *Examine.* 3. Shielding on loudspeaker cable "grounded imperfectly" to car. *Examine; provide good grounding.* 4. Iron filings or dirt between voice coil and pole-piece. *Examine; clean out.* 5. Voice coil "scraping" against pole-piece. *Check centering; re-center voice coil.* 6. Voice coil wires "loose" ("buzzing" sound). *Examine. Push turns of coil carefully together and apply thin coil cement.* 7. Cone spider "broken." *Examine; voice-coil centering test.* 8. Cone torn, worn, seam open, loose around edges. *Examine; repair or replace.*	1. Loudspeaker "mounted loosely." *Examine; tighten.* 2. Shielding on speaker cable "grounded" imperfectly to car. *Examine; "ground" well.* 3. Connection "loose." *Examine.* 4. Iron filings or dirt between voice coil and pole piece. *Examine; clean out.* 5. Voice coil "scraping" agaiost pole-piece. *Check centering; re-center voice coil.* 6. Voice coil wires loose. *Examine. Push turns of coil carefully together and apply thin coil cement.* 7. Cone spider "broken." *Examine; center voice-coil.* 8. Cone torn, worn, seam open, loose around edges. *Examine; repair; replace.* 9. Intermittent "open" in speaker cable wires. *Check con-*
(Cont'd)										

—*Continued on next page*—

TROUBLE-SHOOTING "REMINDER" CHART FOR COMMON "AUTO-RADIO" RECEIVER TROUBLES—*(Cont'd)*

Possible Trouble Sources	*Symptoms of Trouble*										
	"Dead" Receiver	*Intermittent Reception*	*Fading*	*Weak*	*Excessive Hum*	*Oscillation*	*Distortion & Rattling*	*"Noisy" (Both Car & Engine at rest)*	*"Noisy" (Car at Rest Engine Idling)*	*"Noisy" (When Car is driven normally)*	*"Noisy" (When Car coasts with ignition off)*
Loud-Speaker *(Cont'd)*							*Examine; repair or replace.* 8. Speaker "overloaded," or "not unmatched to output." *Test for distortion at lower volumes.* 9. Push-pull output transformer primary section "open." *Check plate voltages; ohmmeter test.*	8. Cone apex "loose" (magnetic speaker). *Tighten.*	8. Intermittent "open" in speaker cable wires. *Check continuity while "jerking" cable wires.* 9. Cone apex of magnetic type speaker "loose." *Examine; repair or replace cone.*	around edges. *Examine; repair or replace.* 9. Intermittent "open" in speaker cable wires. *Check continuity while "jerking" cable wires.* 10. Cone apex of magnetic type speaker "loose." *Tighten.*	*tinuity while "jerking" cable wires.* 10. Cone apex of magnetic speaker "loose." *Tighten.*
Miscellaneous	1. Receiver not turned "on." *Examine.* 2. Receiver "connected incorrectly" *Examine.* 3. S. O. S. on air. *Try another radio set.*	1. Fault of radio station. *Try other stations.* 2. Bad "fading" due to driving car through radio "dead-spots." *See if reception is steady while car is stationary for a sufficient period.*	1. Fault of radio station. *Try other stations.* 2. "Fading" due to driving car through bad radio "dead-spots." *Check reception with car stationary.* 3. Car motion "shifts" remote-control cables. *If volume can be brought back up by re-tuning radio slightly, strap remote-control cables and tuning-control head in position securely.*	1. Sensitivity of receiver inadequate for location car is used in. *Try a more sensitive receiver, or a more efficient aerial system.* 2. Reception attempted in a radio "dead-spot."	1. "Hum" picked up from power lines along road. *Notice if hum stops when antenna is disconnected from receiver (with car and engine stopped). Try with car away from power lines.*	1. Two stations broadcasting at, or near, same frequency ("heterodyning"). *Try different stations; make sure tuned circuits are aligned properly.*	1. Output stage of loud-speaker "overloading." *Operate receiver with reduced volume-control setting.* 2. Two stations broadcasting at, or near, same frequency. *Try tuning in a different station.*	1. Car near trolley wires, high-voltage wires, or otherwise "noisy" spot. *Test in a "quiet" location.* 2. Particular type of receiver generally "noisy." *Past experience; substitute another receiver in car.*	1. "Re-radiation from bodies of passengers (car with wooden floor or dashboard and roof-type aerial). *If interference varies with no. of pass. in car, place "grounded" copper screen under floor mat.* 2. Car near trolley wires, high-voltage wires, or otherwise "noisy" location. *Test radio in a "quiet" location.* 3. Particular type of receiver generally "noisy." *Past experience; substitute another receiver in car.*	1. "Re-radiation" from bodies of passengers (car with wooden floor or dashboard. and roof-type aerial.) *If interference varies with no. of pass. in car, place "grounded" copper screen under floor mat.* 2. Particular type of receiver generally "noisy." *Past experience; substitute another receiver in car.* 3. Car near trolley wires, high-voltage wires, or otherwise "noisy" location. *Test radio in a "quiet" location.*	1. Car near trolley wires, high-voltage wires, or otherwise "noisy" location. *Test radio in a "quiet" location.* 2. Particular type of receiver generally "noisy." *Past experience; substitute another receiver in car.*

GEAR RATIOS & SCALE CALIBRATION DIRECTIONS REQUIRED IN REMOTE TUNING CONTROL HEADS FOR ALL AUTO RADIOS

FOLLOWING is a tabulation of the correct gear ratios and tuning scale calibration directions required in remote tuning control heads to be used with the various makes and models of auto-radio receivers manufactured since 1933.

This information is necessary when ordering "dash-board" type remote tuning control heads for auto-radio receivers, both new and old.

Use of "Universal" Type Control Heads

Use of "universal" types of control heads containing interchangeable gears which enable the service shop to take care of every need with but a small inventory of parts has become most popular. These single-unit pre-assembled controls with their interchangeable gears usually obtainable for 6, 8, 10, 12, 16 and 20 to 1 ratios, are also easy to install.

How to Determine the Correct Gear Ratio Required for a New Tuning Control Head for any Auto-Radio Receiver Not Listed Here

Count the number of complete revolutions of the flexible shaft required to turn the receiver tuning condenser rotor plates from "fully open" to "fully meshed" position, and multiply by 2. The result is the correct gear ratio required for the tuning control head.

Example: It requires 6 complete revolutions of the flexible shaft to turn the tuning condenser rotor plates of an Acratone 88-H auto radio receiver from "fully open" to "fully meshed" position. We have then, *6 revolutions* $\times$ *2* $=$ *12*. The correct tuning head GEAR RATIO required is therefore *12:1*.

How to Determine the Gear Ratio of Any Existing Control Head

Determine the number of revolutions the tuning knob of the control head must be turned to cause one "full-scale" movement of the dial or pointer, then multiply by 2.

Example: By turning the tuning knob of a certain control head and watching the tuning pointer, it is found that *4* revolutions of the tuning knob cause the pointer to move over the complete calibrated scale. We have then, *4* $\times$ *2* $=$ *8*. The GEAR RATIO is therefore *8:1*.

GEAR RATIOS & SCALE CALIBRATION DIRECTIONS OF AUTO-RADIO REMOTE TUNING CONTROL HEADS

Auto-Radio Make	*Model No.*	*Year*	*Gear*	*Scale† Direction*
ACRATONE	88-H	1937	12:1	CCW
(*Federated Purchaser Inc.*)	89-H	1937	12:1	CCW
	90-H	1937	12:1	CCW
	190-K	1938	12:1	CCW
	*205-K	1938	6:1	------
	259-B	1936	12:1	CCW
	260-B	1936	12:1	CCW
	*(*No dial—Push-button tuning*)			
ADMIRAL	*55	1938	8:1	CCW
(*Continental Radio & Telev. Co.*)	66	1937	12:1	CCW
	69	1938	12:1	CCW
	77	1937	12:1	CCW
	78	1937	12:1	CCW
	88	1937	12:1	CCW
	*(*No gear drive—(string). No panel kit used. "5 push-buttons under dash" type*)			
AIRLINE	16U1	____	8:1	CCW
(*Montgomery Ward*)	102	1934	6:1	CW
	118	1934	8:1	CW
	130	1934	6:1	CW
	166	1935	8:1	CCW
	200	1934	12:1	CCW
	202	1935	12:1	CCW
	204	1935	6:1	CCW
	234	1936-7	12:1	CCW
	236	1936-7	12:1	CCW
	242	1936-7	12:1	CCW
	258	1936-7	12:1	CCW
	263	1936-7	12:1	CCW
	*334	1938	------	------
	364	1938	16:1	CCW
	*(*No panel kit used*)			
AMERICAN BOSCH CORP. (see Bosch)	------	------	------	------
ARCADIA	*C-6	1938	-----	------
	C-7	1937	12:1	CCW
	6-C-1	1937	12:1	CCW
	6-C-11	1939	16:1	CCW
	6-J	1937	12:1	CCW
	6-K	1936	12:1	CCW
	6-L	1936	12:1	CCW
	6-N	1936	12:1	CCW
	6-P	1936	12:1	CCW
	6-R	1935	12:1	CCW
	6-S	1935	8:1	CCW
	6-T	1935	8:1	CCW
	6-U	1934	8:1	CW
	*(*Push-button tuning. Separate controls are not used*)			

(*Cont'd over*)

†**Note:** *CW indicates that the tuning control head must be ordered with a tuning scale calibrated to "increase" KC readings with "clockwise" rotation of the condenser drive cable (when viewed from the front of the control head). CCW indicates that reverse calibration is required (scale must be calibrated to "increase" KC readings with "counter-clockwise" rotation of the condenser drive cable when viewed from the front of the control head).*

(Continued from preceding page)

Auto-Radio Make	Model No.	Year	Gear Ratio	Scale† Direction
ARVIN	5	1938	12:1	CW
	*6	1938	———	———
	7-A	———	16:1	CW
	9-A	1937	16:1	CW
	17	1935	16:1	CW
	18	1936	16:1	CW
	19	1937	16:1	CW
	22-A	1938	16:1	CW
	27	1935	16:1	CW
	28	1936	16:1	CW
	29	1937	16:1	CW
	30-A	1936	16:1	CW
	32	1938	16:1	CW
	33	1936	16:1	CW
	37	1935	16:1	CW
	38	———	16:1	CW
	39	1937	16:1	CW
	42	1938	16:1	CW
	44-C	———	16:1	CW
	710	———	16:1	CW
	810	———	16:1	CW
*(No dial — 6 push-buttons — "trimmer tuned")				
ATWATER KENT (no longer manufacturing radio receivers)	666	———	8:1	CCW
AUDIOLA (also see Fairbanks-Morse)	*33A6	1933	10:1	CCW
	*33S6	1933	10:1	CCW
	*33S7	1933	10:1	CCW
	346	1934	6:1	CW
	347	1934	6:1	CW
AUTOMATIC RADIO MFG. CO. (see Autorola)	———	———	———	———
AUTOMATIC, AUTOROLA (Automatic Radio Mfg. Co.)	*A-5	1936	6:1	CCW
	A-6	1936	6:1	CCW
	J-80	1936	6:1	CCW
	M-10	1937	16:1	CCW
	M-20	1937	16:1	CCW
	M-30	1937	16:1	CCW
	M-60	1937	16:1	CCW
	M-67	1937	16:1	CCW
	M-70	1937	16:1	CCW
	M-80	1937	16:1	CCW
	P-70	1938	16:1	CCW
*(Built-in dials, and do not employ a remote control. Custom panels not available for these sets)				
BELMONT	566	1936	6:1	CW
	*577	1938	6:1	———
	580	———	6:1	CCW
	661	1937	12:1	CCW
	666	1936	12:1	CW
	667	1937	12:1	CCW
	670	———	6:1	CCW
	670-A	———	6:1	CCW
	*677	1938	6:1	———
	680	1934-5	6:1	CW
	690	1934-5	6:1	CW
	880A	1935	6:1	CW
	880B	1935	6:1	CW
	880C	1936-7	6:1	CW
	880D	1936-7	6:1	CW
	881	1937	12:1	CCW
*(No dial—push-button tuning)				

(Cont'd)

Auto-Radio Make	Model No.	Year	Gear Ratio	Scale† Direction
B. O. P. (See also Buick, Olds., Pontiac)	980393	———	6:1	———
	980441	(some)	6:1	———
		(others)	8:1	———
	980455	———	8:1	———
	980459	———	8:1	———
BOSCH	536-B	1936-7	16:1	CW
	636	1936-7	16:1	CW
	637	1936-7	16:1	CW
	736	1936-7	16:1	CW
	737	1936-7	16:1	CW
	738	1936-7	16:1	CW
	838	1936-7	16:1	CW
BUICK (Delco)	980507	———	16:1	CW
	980508	———	16:1	CW
CHEVROLET (Delco)	600565	———	8:1	CW
	985100	———	16:1	CW
	985200	———	16:1	CW
	985300	———	16:1	CW
	985252	———	16:1	CW
	985253	———	16:1	CW
	985254	———	16:1	CW
	985255	———	16:1	CW
	985301	———	16:1	CW
	985400	———	16:1	CW
CHRYSLER (see Philco)	———	———	———	———
CLINTON (Clinton Mfg. Co.)	*801	1935-6	———	CW
	802	1935-6	12:1	CCW
	803	1935-6	12:1	CCW
	804	1937	16:1	CW
	805	1937	16:1	CW
	806	1937	16:1	CW
	807	1937	16:1	CW
	**808	1938	———	———
	809	1938	16:1	CW
*"Direct" drive **Push-button tuning and "direct" drive				
CONTINENTAL RADIO & TELEV. CORP. (see Admiral)	———	———	———	———
CROSLEY	5A3	———	6:1	CCW
	99	———	6:1	CCW
	102	———	6:1	CCW
	A-156	1936	6:1	CW
	A-157	1937-8	6:1	CW
	A-158	1938	6:1	CW
	A-166	1936	6:1	CW
	A-167	1937-8	16:1	CW
	A-177	1937-8	16:1	CW
	A-258	1938	4:1	CW
	A-266	1937	16:1	CW
	A-267	———	16:1	CW
	A-366	1937	16:1	CW
	Roamio	———	12:1	CW
DELCO (United Motors Service) See also, Chevrolet & Oldsmobile & Pontiac	500	———	12:1	CW
	626	———	12:1	CW
	627	———	12:1	CW
	628	———	12:1	CW
	629	———	12:1	CW
	630	———	12:1	CW
	631	1936	12:1	CW

(Cont'd)

†Note: *CW indicates that the tuning control head must be ordered with a tuning scale calibrated to "increase" KC readings with "clockwise" rotation of the condenser drive cable (when viewed from the front of the control head).*

CCW indicates that reverse calibration is required (scale must be calibrated to "increase" KC readings with "counter-clockwise" rotation of the condenser drive cable when viewed from the front of the control head).

(Continued from preceding page)

Auto-Radio Make	*Model No.*	*Year*	*Gear Ratio*	*Scale† Direction*
DELCO *(Cont'd)*	632	1936	12:1	CW
	633	1936	12:1	CW
	634	1936	12:1	CW
	635	1936	12:1	CW
	R-640	1937	12:1	CW
	R-641	1937	12:1	CW
	R-642	1937	12:1	CW
	R-643	1937	12:1	CW
	R-644	1937	12:1	CW
	663	1937	8:1	CCW
	664	1937	12:1	CW
	665	1937	12:1	CW
	666	1937	12:1	CW
	667	1937	12:1	CW
	668	1937	12:1	CW
	669	1937	12:1	CW
	R-676	———	12:1	CW
	R-686	———	12:1	CW
	4033	———	12:1	CW
DE SOTO (see Philco)	———	———	———	———
DETROLA	6M	1935	8:1	CCW
	6R	1935	8:1	CCW
	111	1936	12:1	CCW
	112	1936	12:1	CCW
	166	1937	12:1	CCW
	171	1937	12:1	CCW
DE WALD	517	1936	6:1	CW
	517LW	1936	6:1	CW
	517-R	1936	6:1	CW
	527	1937	8:1	CW
	605	1936	6:1	CW
	605-R	1936	6:1	CW
	606	1935	6:1	CW
	606-R	1935	6:1	CW
	607	1935	6:1	CW
	608	1935	6:1	CW
	617	1937	8:1	CW
	640	1934	6:1	CW
	640-R	1934	6:1	CW
	702	1937	8:1	CW
DODGE (see Philco)	———	———	———	———
EMERSON *(Emerson Radio & Telev. Corp.)*	1-A	1935-6	10:1	CW
	5-A	1935-6	10:1	CW
	6-A	1935-6	10:1	CW
	E-128	1935-6	10:1	CW
	U-154	1937	16:1	CW
	V-155	1937	16:1	CW
	667	1935	6:1	CW
	678	1935	6:1	CW
	965	1935	6:1	CW
FADA *(Fada Radio & Electric Co.)*	266	1936	16:1	CW
	266-SD	1936	16:1	CW
	266-SF	1936	16:1	CW
	266-SG	1936	16:1	CW
	267	1937-8	16:1	CW
	267-SD	1937-8	16:1	CW
	267-SF	1937-8	16:1	CW
	267-SG	1937-8	16:1	CW
	267-X	1937-8	16:1	CW

(Cont'd)

Auto-Radio Make	*Model No.*	*Year*	*Gear Ratio*	*Direction*
FAIRBANKS-MORSE (also see Audiola) *(no auto-radio sets manufactured by this company since 1935)*	*C6	1935	8:1	CW
	*64	1935	8:1	CW
	*74	1935	8:1	CW
(Some receivers were supplied with 12:1 worms to be used with De Luxe heads to match certain cars)				
FEDERATED PURCHASER, INC. (see Acratone)	———	———	———	———
FIRESTONE	F-258	1938	2¼:1	CCW
	R-1311	1935	8:1	CCW
	R-1322	1935	8:1	CCW
	R-1332	1935	8:1	CCW
	R-1431	1936	8:1	CW
	R-1781	1937	16:1	CW
FORD (see Philco)	———	———	———	———
GALVIN MFG. CO. (see Motorola)	———	———	———	———
GENERAL ELECTRIC *(General Electric Co.)*	C-41	1934	6:1	CCW
	C-60	1934	6:1	CCW
	C-61	1934	8.1	CCW
	D-50	1935	10:1	CW
	D-51	1935	10:1	CW
	D-52	1935	10:1	CW
	D-72	1935	10:1	CW
	FA-60	1937	12:1	CW
	FA-61	1937	12:1	CW
	FA-80	1937	12:1	CW
	N-60	1936	12:1	CCW
GENERAL HOUSEHOLD UTILITIES CO. (see Grunow)	———	———	———	———
GILFILLAN *(Gilfillan Bros. Inc.)*	X	1935	6:1	CCW
	8A	1935	10:1	CW
	8X	1936	8:1	CCW
	67-A	1937	12:1	CW
	67-B	1937	12:1	CW
	77-A	1937	12:1	CW
	87-A	1937	12:1	CW
GRAHAM PAIGE *(RCA)*	101	1935	10:1	CW
GRUNOW *(General Household Utilities Co.)*	614	1936	16:1	CCW
	618	1936	16:1	CCW
	625	1936	16:1	CCW
HERBERT H. HORN MFG. CO. (see Tiffany Tone)	———	———	———	———
HOWARD *(Howard Radio Co.)*	HA-1	1933	12:1	CW
	HA-2	1934	12:1	CW
	HA-3	1935	12:1	CW
	HA-5	1936	12:1	CW
	HA-6	1936	12:1	CW
	HA-7	1937-8	12:1	CW
	HA-8	1937-8	12:1	CW
	HA-9	1937-8	12:1	CW

(Cont'd over)

†**Note:** *CW indicates that the tuning control head must be ordered with a tuning scale calibrated to "increase" KC readings with "clockwise" rotation of the condenser drive cable (when viewed from the front of the control head).*

CCW indicates that reverse calibration is required (scale must be calibrated to "increase" KC readings with "counter-clockwise" rotation of the condenser drive cable when viewed from the front of the control head).

(Continued from preceding page)

Auto-Radio Make	Model No.	Year	Gear Ratio	Scale† Direction
HUDSON (Hudson Motors)	A680	____	8:1	CW
	CB-37	____	16:1	CW
	680	____	8:1	CW
HUPMOBILE	HT-1	____	16:1	CW
	HT-2	____	16:1	CW
KARADIO (Karadio Corp.)	F-6	1937	12:1	CCW
	75	1937	12:1	CCW
	76	1937	12:1	CCW
	77	1937	12:1	CCW
	78	1937	12:1	CCW
KNIGHT (Allied Radio Corp.)	69	____	12:1	CCW
LAFAYETTE	B-90	1936	12:1	CW
	B-92	1937	12:1	CW
	B-93	1937	12:1	CW
	C-60	1935	6:1	CCW
	D-15	1938	16:1	CW
	D-37	1938	16:1	CW
	D-39	1938	16:1	CW
	D-45	1935	8:1	CCW
	D-46	1935	8:1	CCW
	D-52	1935	8:1	CCW
	EB-17	1938	16:1	CCW
	L-30	1934-5	8:1	CCW
	LW-10	1934	6:1	CCW
	M-94	1938	16:1	CW
LINCOLN ZEPHYR	1560	____	16:1	CW
	1565	____	16:1	CW
MAJESTIC TWIN (Grigsby-Grunow Co.)	6-66	____	6:1	CW
	66	____	6:1	CW
MISSION BELL	11	1934-5	6:1	CW
	14	1934-5	6:1	CW
	638	1938	12:1	CCW
	638A	1938	12:1	CCW
	3516	1934-5	6:1	CW
	3616	1936	12:1	CCW
	3617	1936	12:1	CCW
	3618	1936	12:1	CCW
	3716	1937	12:1	CCW
	3717	1937	12:1	CCW
	3718	1937	12:1	CCW
MONTGOMERY WARD & CO. (see Airline)	----	----	----	----
MOTOROLA (Galvin Mfg. Co.)	Dual 6	1934	12:1	CW
	Golden Voice	1937	12:1	CW
	Super 6	1933	16:1	CW
	Twin 8	1934	12:1	CW
	5-T-71A	1929	10:1	CW
	6-T-12	1930	10:1	CW
	7-T-38	1931	10:1	CW
	7-T-47A	1932	10:1	CW
	8-30	1938	12:1	CW
	8-40	1938	12:1	CW
	8-50	1938	12:1	CW
	8-60	1938	12:1	CW
	8-70	1938	12:1	CW
	8-80	1938	12:1	CW
	34	1934	12:1	CW
	35	1937	12:1	CW
	44	1933	16:1	CW
	45	1937	12:1	CW

(Cont'd)

Auto-Radio Make	Model No.	Year	Gear Ratio	Scale† Direction
MOTOROLA (Cont'd)	50	1936	12:1	CW
	55	1933	12:1	CW
	57	1935	12:1	CCW
	60	1936	16:1	CW
	60-A	1936	12:1	CW
	61	1932	10:1	CW
	65	1937	12:1	CW
	70	1937	12:1	CW
	75	1935	12:1	CW
	77	1933	12:1	CW
	77-A	1933	12:1	CW
	77-AB	1933	12:1	CW
	80	1936	12:1	CW
	88	1932	10:1	CW
	90 G.V.	1936	12:1	CW
	100	1935	12:1	CCW
NASH	NT-7	____	16:1	CW
	NT-8	____	16:1	CW
	NT-12	____	16:1	CW
	NT-15	____	16:1	CW
	1418	____	16:1	CW
	1434	____	16:1	CW
	1514	____	16:1	CW
	1524	____	16:1	CW
NOBLITT-SPARKS (see Arvin)	----	----	----	----
OLDSMOBILE (Delco)	982006	1936	20:1	CW
	982007	1936	20:1	CW
	982008	1936	20:1	CW
	982043	____	20:1	CW
	982044	____	20:1	CW
	982045	____	20:1	CW
	982083	____	16:1	CW
	982084	____	16:1	CW
	982085	____	16:1	CW
PACKARD (see Philco)	----	----	----	----
PACKARD BELL	5	1934-5	6:1	CW
	7	1934	6:1	CW
	25	1935-6	6:1	CW
	65	1936-7	12:1	CW
	67	1936-7	12:1	CW
	75	1937-8	16:1	CCW
	76	1937-8	16:1	CCW
	78	1937-8	16:1	CCW
PHILCO (Transitone)	(Chrysler, Dodge, De Soto, Plymouth) CT-2	____	16:1	CW
	CT-5	____	16:1	CW
	CT-10	____	16:1	CW
	CT-11	____	16:1	CW
	G	____	16:1	CW
	1450	1937	16:1	CW
	1452	1937	16:1	CW
	1550	1938	16:1	CW
	(Ford) FT-6	____	16:1	CW
	FT-9	____	16:1	CW
	1440	1937	16:1	CW
	1442	1937	16:1	CW
	1540	1938	16:1	CW
	(Packard) PHD	1935	16:1	CW
	PT5	1935	16:1	CW
	P1417	1937	16:1	CW
	P1421	1937	16:1	CW
	P1430	1937	16:1	CW
	P1517	____	16:1	CW
	P1530	____	16:1	CW

(Cont'd)

†Note: *CW indicates that the tuning control head must be ordered with a tuning scale calibrated to "increase" KC readings with "clockwise" rotation of the condenser drive cable (when viewed from the front of the control head).*

CCW indicates that reverse calibration is required (scale must be calibrated to "increase" KC readings with "counter-clockwise" rotation of the condenser drive cable when viewed from the front of the control head).

(Continued from preceding page)

Auto-Radio Make	Model No.	Year	Gear Ratio	Scale† Direction
PHILCO *(Cont'd)*	*Packard* P1533	------	16:1	CW
	P1535	------	16:1	CW
	Philco 5	1933	16:1	CCW
	6	1932-3	16:1	CCW
	6-F	1932-3	16:1	CCW
	10	1933-4	10:1	CCW
	11	1934	16:1	CCW
	70	------	10:1	CCW
	700	1934	10:1	CCW
	800	1934	10:1	CCW
	802	1934	10:1	CCW
	805	1935	16:1	CW
	806	1935	16:1	CW
	807	1935	16:1	CW
	808	1935	16:1	CW
	809	1935	16:1	CW
	816	1936	16:1	CW
	817	1936	16:1	CW
	818	1936	16:1	CW
	818-K	1936	16:1	CW
	819	1936	16:1	CW
	819-H	1936	16:1	CW
	826	1937	16:1	CW
	827	1937	16:1	CW
	827-K	1937	16:1	CW
	828	1937	16:1	CW
	828-K	1937	16:1	CW
	829	1937	16:1	CW
	926	1938	16:1	CW
	927	1938	16:1	CW
	928-K	1938	16:1	CW
	936	------	16:1	CW
	937	------	16:1	CW
	937-X	------	16:1	CW
	938-K	------	16:1	CW
	938-KX	------	16:1	CW
PIERCE AIRO INC. (see De Wald)	------	------	------	------
PLYMOUTH (see Philco)	------	------	------	------
PONTIAC	980393	------	6:1	------
	980441	(some)	6:1	------
		(others)	8:1	------
	980455	------	8:1	------
	980459	------	8:1	------
	983506	------	16:1	------
	983507	------	16:1	------
	983526	------	16:1	------
	983527	------	16:1	------
	983534	------	16:1	------
	983569	------	16:1	------
	983570	------	16:1	------
	983617	------	16:1	------
RCA-VICTOR	M-30	1932	10:1	CW
	M-32	1932	21:1	CCW
	M-34	1933	10:1	CW
	M-101	1935	10:1	CW
	M-104	1935	10:1	CW
	M-105	1934	10:1	CW
	M-107	1934	7:1	CW
	M-108	1935	10:1	CW
	M-109	1935	10:1	CW
	M-116	1934	2:1	CW
	M-123	1934	7:1	CW
	5-M	1936	*16:1-12:1**	CW
	6-M	1936	*16:1-12:1**	CW
	6-M2	1936	*16:1-12:1**	CW

(Cont'd)

Auto-Radio Make	Model No.	Year	Gear Ratio	Scale† Direction
RCA-VICTOR *(Cont'd)*	8-M	1938	9:1	CW
	8-M1	1938	16:1	CW
	8-M2	1938	16:1	CW
	8-M3	1938	16:1	CW
	8-M4	1938	16:1	CW
	9-M1	1938-9	2:1-2:1	CW
	9-M2	1938-9	2:1-2:1	CW
	67-M	1937	16:1	CW
	67-M1	1937	16:1	CW
	67-M2	1937	16:1	CW
	67-M3	1937	16:1	CW

*(On receivers bearing Serial Numbers 200,000 and above)

**(On receivers bearing Serial Numbers below 200,000)

REMLER	35	1934	6:1	CW
	36	1935	8:1	CW
	37	1936	6:1	CW
SEARS ROEBUCK & CO. (see Silvertone)	------	------	------	------
SETCHELL-CARLSON	66	------	6:1	CCW
SILVERTONE	1949	1936-7	16:1	CW
	1949-A	1936-7	16:1	CW
	4600	1936-7	16:1	CW
	4601	1936-7	16:1	CW
	4700	1938	16:1	CW
	6000	1938	16:1	CW
	6001	1938	16:1	CW
	6100	1938	16:1	CW
	6101	1938	16:1	CW
SIMPLEX	Q	1935-6	8:1	CW
	TA	1935-6	8:1	CW
SPARKS-WITHINGTON CO. (see Sparton)	------	------	------	------
SPARTON *(Sparks Withington Co.)*	D-686	1936	16:1	CCW
	H-686	1936	16:1	CCW
	S-676	1936	16:1	CCW
	S-686	1936	16:1	CCW
	33-A	1934	6:1	CCW
	33-B	1934	6:1	CCW
	36	1934	6:1	CW
	333	1934	6:1	CW
	686	1936	16:1	CCW
STEWART-WARNER	1121-2	1934	6:1	CCW
	1171-2	1934	8:1	CCW
	1181-2	1934	8:1	CCW
	1311-4	1935	8:1	CCW
	1322	1935	8:1	CCW
	1332	1935	8:1	CCW
	1431	1936	8:1	CW
	1601	1936	8:1	CCW
	1781	1937	16:1	CW
STUDEBAKER	ST-3	------	10:1	CW
	ST-12	------	10:1	CW
	ST-15	------	10:1	CW
	1416	------	16:1	CW
	1516	------	16:1	CW
	1526	------	16:1	CW
TERRAPLANE	A-680	------	8:1	CW
	------	1937	16:1	CW

(Cont'd over)

†Note: *CW indicates that the tuning control head must be ordered with a tuning scale calibrated to "increase" KC readings with "clockwise" rotation of the condenser drive cable (when viewed from the front of the control head).*

CCW indicates that reverse calibration is required (scale must be calibrated to "increase" KC readings with "counter-clockwise" rotation of the condenser drive cable when viewed from the front of the control head).

(Continued from preceding page)

Auto-Radio Make	Model No.	Year	Gear Ratio	Scale† Direction
TIFFANY TONE (*Herbert H. Horn Mfg. Co.*)	535	1935	6:1	CCW
	536	1935	6:1	CCW
	537	1936	6:1	CW
	538	1936	6:1	CW
	557	1937-8	12:1	CCW
TRANSITONE (see Philco)	------	------	------	------
TRAV-LER	54-A	1934-5	6:1	CW
	64	1934-5	6:1	CW
	542	1936	12:1	CCW
	601	1937	12:1	CW
	642	1936	12:1	CCW
	660	1937	12:1	CW
	770	1937	12:1	CW
TRUETONE (*Western Auto Supply*)	D-734	1936-7	12:1	CCW
	D-743	1936-7	12:1	CCW
	D-744	1936-7	12:1	CCW
	D-745	1936-7	12:1	CCW
	*D-746	1938	------	------
	*D-747	1938	------	------
	*(*No remote control*)			
UNITED AMER. BOSCH CORP. (see Bosch)	------	------	------	------
UNITED MOTORS SERVICE (see Delco)	------	------	------	------
UNIVERSAL	804	1937	16:1	CW
	805	1937	16:1	CW
	806	1937	16:1	CW
	807	1937	16:1	CW
WARWICK	511	1935	6:1	CCW
	*559	1938	------	------
	560	1936	8:1	CCW
	592	1936	8:1	CCW
	611	1935	6:1	CCW
	646	1937	16:1	CW
	*659	1938	------	------
	660	1936	8:1	CCW
	746	1937	16:1	CW
	747	1938	16:1	CW
	846	1937	16:1	CW
	*(*No dial—push-button tuning*)			
WELLS-GARDNER & CO. (see Arcadia)	------	------	------	------
WESTERN AUTO SUPPLY CO. (see Truetone)	------	------	------	------
WESTINGHOUSE (*Manufacture of auto radios discontinued after 1937*)	WR-25	1934-5	6:1	CCW
	WR-26	1934-5	6:1	CCW
	WR-500	1935-6	6:1	CCW
	WR-501	1935-6	16:1	CW
	WR-502	1936-7	16:1	CW
	WR-503	1936-7	16:1	CW
WILLYS	1419	------	16:1	CW
WHOLESALE RADIO CO. (see Lafayette)	------	------	------	------

Auto-Radio Make	Model No.	Year	Gear Ratio	Scale† Direction
ZENITH	5M-90	1936	8:1	CW
	5M-191	1937	12:1	CW
	6M-90	1936	12:1	CW
	6M-91	1936	12:1	CW
	6M-92	1936	12:1	CW
	6M-192	1937	16:1	CW
	6M-193	1937	16:1	CW
	6M-194	1937	16:1	CW
	6M-292	1938	16:1	CW
	6M-293	1938	16:1	CW
	6M-295	1938	16:1	CW
	7M-91	1936	12:1	CW
	8M-195	1937	16:1	CW
	460	1934	6:1	CCW
	462	1934	6:1	CCW
	663	1935	8:1	CW
	664	1935	8:1	CCW
	666	1935	8:1	CCW
	668	1935	8:1	CW
ZEPHYR	*Z577	1938	------	------
	**Z677	1938	------	------
	3-M-7	1937	16:1	CW
	3-M-8	1937	16:1	CW
	*(*No remote control unit*)			
	**(*Tuner in remote unit*)			
(Use this space for listing data on new models)				

(Cont'd)

†Note: *CW indicates that the tuning control head must be ordered with a tuning scale calibrated to "increase" KC readings with "clockwise" rotation of the condenser drive cable (when viewed from the front of the control head).*

CCW indicates that reverse calibration is required (scale must be calibrated to "increase" KC readings with "counter-clockwise" rotation of the condenser drive cable when viewed from the front of the control head).

ROUTINE AUTO-RADIO INSTALLATION & INTERFERENCE ELIMINATION DATA CHART FOR ALL AMERICAN PASSENGER CARS

(Recommended external antenna types & locations; built-in antennas and locations of lead-ins; car battery grounded terminal; correct breaker-point and spark-plug gaps; generator "charging rates"; recommended noise suppressor, by-pass condenser, bonding, wheel-static collector and shielding installation instructions for all American passenger cars)

A WEALTH of reference data which servicemen will find very helpful in routine auto-radio installation and service work is presented in the following chart in a condensed and specially arranged form which makes quick reference possible. The data is presented for all American cars made since 1933, each group being arranged alphabetically according to manufacturer.

The various vertical columns tell, in turn, which terminal of the car battery is grounded, the correct breaker-point and spark plug gaps, the maximum normal charging rate it is safe to set the generator for when hot, where noise suppressor resistors should be installed in the ignition system of the car, where by-pass condensers should be installed, what parts of the car should be "grounded" (by means of copper bonding braid, bonding straps, or other appropriate means), whether static-collectors should be installed in the front wheels, whether the car comes from the factory already equipped with a built-in antenna or not (and where the lead-in wire will be found when an antenna has been provided), and the type and location of external antenna recommended by the car manufacturer in cases where no antenna has already been provided.

Careful Installation Workmanship Essential

The increased sensitivity engineered into modern auto-radios has thrown the burden of noise elimination on to the radio serviceman. Automobile manufacturers recommend the installation of suppressor resistors, by-pass condensers, grounding bonds, grounding straps, and static collectors at certain points in their cars (as directed in this chart)—but expert installation of these, with close attention paid to all details, is essential if noise-free reception is to be obtained. For example, when by-pass condensers (with grounded can) are being installed, all paint, rust, dirt, etc., must be scraped from the metal surfaces where the condenser is being fastened and connected, so that good electrical contact will be made. The same precautions must be taken to insure good electrical contact when ground straps and bonding are installed. When wheel static collectors containing a button that contacts the center of the axle are installed in the front wheels, be sure to remove any burrs from the center of the axle, as these will quickly wear the button down. Also, clean any grease and dirt from the contacting surface. The cotter pin on the axle nut should be bent flat against the flats of the nut so that it will not interfere with the static collector.

Supplementary Comments to Data in Chart

The following comments are intended to supplement the data contained in the chart.

(*1*) *Car Battery Terminal Groun* adio receiver using a *non-synchronous* vib e satisfactorily regardless of car battery polarity (regardless of which terminal of the car battery is grounded), but if it employs a *synchronous* vibrator-rectifier, proper battery polarity is essential and must be provided. Accordingly, those later receivers which employ a *synchronous* vibrator, use a synchronous vibrator with a reversible plug to permit convenient change-over of polarity. In those earlier receivers using synchronous vibrators that cannot be reversed in the socke , it is necessary to reverse either the primary or the secondary transformer leads. Some sets are provided with change blocks for this purpose. In all this work, it is helpful to know in advance just what the car battery polarity is—it can be found from this chart for any car.

(*2*) *By-pass Condensers*: Non-inductive type by-pass condensers should be installed and connected between the grounded frame of the car and each of the points listed in the *by-pass condenser* column. Their connecting leads should be kept as short as possible if the condensers are to be effective in by-passing all r-f disturbances. All contacts should be clean and tight. Condensers installed in the engine compartment should be of the type designed to operate satisfactorily under the high-temperature conditions existing there during operation of the car during the summer months.

When installing a generator by-pass condenser be sure that its lead is connected to the *armature* terminal of the generator, for if it is connected to the field terminal it will cause pitting of the voltage regulator points.

(*3*) *"Bonding" and "Grounding"*: Proper bonding and grounding of certain car parts is often more important in auto-radio interference elimination than the installation of by-pass condensers—consequently great care must be taken to make certain that good "grounding" is effectively obtained. In many cars, the controls—which include choke, speedometer cable, ignition or spark control, hand throttle, oil gauge tubing, thermometer, etc.—should be grounded to the dash so that they will not conduct r-f disturbances back into the car body.

(*4*) *Built-in Antennas*: Whether or not the car is provided with a built-in antenna, and if it is, on what side of the car the built-in lead-in will be found can be ascertained from the next two columns of the table.

(*5*) *External Antenna Type & Location*: If the car is not already provided with a built-in antenna, the type and location of antenna recommended by the car manufacturer

for installation by the radio serviceman is given in the last column.

By following the recommended instructions tabulated here, the installation of auto-radios in most cars will be greatly simplified and speeded up—making less installation time per auto-radio necessary, with a resulting increase in serviceman's profits. These instructions cover all the measures that are necessary to obtain interference-free auto-radio reception under normal conditions. However, conditions may sometimes differ enough on two cars of the same model so that *additional* interference-elimination measures must be applied. Such cases of "persistent" interference may be handled in accordance with the instructions presented in *Section 11* of this book.

ROUTINE AUTO-RADIO INSTALLATION & CAR IGNITION SYSTEM DATA CHART

Make & Model of Car	Year	Batt. Term. Grounded	Correct Breaker Gap (Inches)	Correct Spark Plug Gap (Inches)	Generator max. normal charging rate: Amps. (Hot)	Volts	Car Speed	Install a Suppressor Resistor in: (Lead)	Connect a By-pass Condenser between Gnd. and:	"Bond" or "Ground" the:	Built-in Antenna Provided in Car:*	Built-in Ant. Lead-in Located at:	External Ant. Type & Location Recommended by Car Mnf'r:‡
Auburn (*no longer mf'd*)													
Auburn (none mfd.)	1937	—	—	—	—	—	—	—	—	—	—	—	
Auburn 654	1936	P	.018	.025	16	8.0	—	Dist.,S.P.	Gen.,I.C.,Amm.	——	Yes	Right	
Auburn 852	1936	P	.018	.025	16	8.0	—	Dist.,S.P.	Gen.,I.C.,Amm.	——	Yes	Right	
Auburn 653	1935	P	.018	.025				Dist.,S.P.	Gen.,I.C.,Amm.	——	Yes	Right	——
Auburn 851	1935	P	.018	.025				Dist.,S.P.	Gen.,I.C.,Amm.	——	Yes	Right	
Auburn Std. 6-52	1934	P	.018	.026				Dist.,S.P.	Gen.,I.C.,Amm.		Yes		
Auburn Cust. 6-52	1934	P	.018	.026				Dist.,S.P.	Gen.,I.C.,Amm.		Yes		
Auburn Cust. 8-50	1934	P	.018	.026				Dist.,S.P.	Gen.,I.C.,Amm.		Yes		
Auburn Std. 8-50	1934	P	.018	.026				Dist.,S.P.	Gen.,I.C.,Amm.		Yes		
Auburn 12-165	1934	P	.018	.025				Dist.,S.P.	Gen.,I.C.,Amm.		Yes		
Auburn 8-101	1933	P	.018	.026				Dist.,S.P.	Gen.,I.C.,Amm.		No		
Auburn 8-105	1933	P	.018	.026				Dist.,S.P.	Gen.,I.C.,Amm.		Yes		
Auburn 12-161	1933	P	.018	.025				Dist.,S.P.	Gen.,I.C.,Amm.		No		
Auburn 12-165	1933	P	.018	.025				Dist.,S.P.	Gen.,I.C.,Amm.		Yes		
Buick 40, 50, 60, 70, 90	1942	N	.015	.025	34	8.0	25	Dist.H.T.	Gen.Arm.,Term.insideI.C.,Bott.Cover	F.W.			TF,orF
Buick 40	1941	N	.015	.025	34	8.0	25	Dist.H.T.	Gen.Arm.,Term.insideI.C.,Bott.Cover	F.W.			TF,orF
Buick 50	1941	N	.015	.025	34	8.0	24	Dist.H.T.	Gen.Arm.,Term.insideI.C.,Bott.Cover	F.W.	—	—	TF,orF
Buick 60, 70	1941	N	.015	.025	34	8.0	26	Dist.H.T.	Gen.Arm.,Term.insideI.C.,Bott.Cover	F.W.	—	—	TF,orF
Buick 90	1941	N	.015	.025	34	8.0	26	Dist.H.T.	Gen.Arm.,Term.insideI.C.,Bott.Cover	F.W.	—	—	TF,orF
Buick 40, Sp., 50 Super	1940	N	.015	.025	34	8.0	20	Dist.H.T.	Gen.Arm.,Term.insideI.C.,Bott.Cover	F.W.	—	—	——
Buick 60 Centy., 70 Rd.	1940	N	.015	.025	34	8.0	20	Dist.H.T.	Gen.Arm.,Term.insideI.C.,Bott.Cover	F.W.	—	—	——
Buick 80 Lt'd.	1940	N	.015	.025	34	8.0	22	Dist.H.T.	Gen.Arm.,Term.insideI.C.,Bott.Cover	F.W.	—	—	——
Buick 90 Lt'd.	1940	N	.015	.025	34	8.0	20	Dist.H.T.	Gen.Arm.,Term.insideI.C.,Bott.Cover	F.W.	—	—	——
Buick Special 40	1939	N	.0125	.025	25	8.0	43	Dist.	Gen.,I.C.				
Buick Century 60	1939	N	.0125	.025	25	8.0	45	Dist.	Gen.,I.C.				
Buick Rdmst. 80	1939	N	.0125	.025	25	8.0	47	Dist.	Gen.,I.C.				
Buick Lt'd. 90	1939	N	.0125	.025	25	8.0	45	Dist.	Gen.,I.C.				
Buick 40	1938	N	.015	.025	28	8.0	40	Dist.	Gen.,I.C.	F.W.	Yes(Insul.R.)	—	——
Buick 60	1938	N	.015	.025	28	8.0	43	Dist.	Gen.,I.C.	F.W.	Yes(Insul.R.)	—	
Buick 80	1938	N	.015	.025	28	8.0	44	Dist.	Gen.,I.C.	F.W.	Yes(Insul.R.)	—	
Buick 90	1938	N	.015	.025	28	8.0	42	Dist.	Gen.,I.C.	F.W.	Yes(Insul.R.)	—	
Buick 40	1937	N	.017	.025	28	8.0	41	Dist.	Gen.,I.C.	F.W.	Yes(Insul.R)	—	
Buick 60	1937	N	.017	.025	28	8.0	47	Dist.	Gen.,I.C.	F.W.	Yes(Insul.R)	—	
Buick 80	1937	N	.017	.027	28	8.0	45	Dist.	Gen.,I.C.	F.W.	Yes(Insul.R)	—	
Buick 90	1937	N	.017	.025	28	8.0	42	Dist.	Gen.,I.C.	F.W.	Yes(Insul.R)	—	
Buick 40	1936	N	.013	.022				Dist.	Gen.	F.W.	No†	Left	
Buick 60	1936	N	.013	.022				Dist.	Gen.	F.W.	No†	Left	
Buick 80	1936	N	.013	.022				Dist.	Gen.	F.W.	No†	Left	
Buick 90	1936	N	.013	.022				Dist.	Gen.	F.W.	No†	Left	
Buick 40	1935	N	.013	.020				Dist.	Gen.,Amm.		Yes	Left	
Buick 50	1935	N	.013	.020				Dist.	Gen.,Amm.		Yes	Left	
Buick 60	1935	N	.013	.020				Dist.	Gen.,Amm.		Yes	Left	
Buick 90	1935	N	.013	.020				Dist.	Gen.,Amm.		Yes	Left	——
Buick 34-50	1934	N	.013	.020							Yes		
Buick 34-60	1934	N	.013	.020							Yes		
Buick 34-90	1934	N	.013	.020							Yes		
Buick 33-50	1933	N	.015	.020							Yes		
Buick 33-60	1933	N	.015	.020							Yes		
Buick 33-80, 90	1933	N	.015	.020							Yes		
Cadillac 60S,61,62,63,67,75	1942	P	.015	.028	34	8.0	27	Dist.H.T.	Gen.Arm.,Term.insideI.C.,Bott.Cover	F.W.,Hood,Engine			S-C(v)
Cadillac V8(60,61,62,63)	1941	P	.015	.027	34	8.0	27	Dist.H.T.	Gen.Arm.,Term.insideI.C.,Bott.Cover	F.W.,Hood,Engine	—	—	S-C(v)
Cadillac V8 (67, 75)	1941	P	.015	.027	34	8.0	27	Dist.H.T.	Gen.Arm.,Term.insideI.C.,Bott.Cover	F.W.,Hood,Engine	—	—	F(v)
Cadillac V8 (60S, 62)	1940	P	.0125	.027	34	8.0	27	Dist.H.T.	Gen.Arm.,Term.insideI.C.,Bott.Cover	F.W.,DashCont.	—	—	——
Cadillac V8 (72, 75)	1940	P	.0125	.027	34	8.0	25	Dist.H.T.	Gen.Arm.,Term.insideI.C.,Bott.Cover	F.W.,DashCont.	—	—	——
Cadillac V16 (90)	1940	P	.0125	.032	34	8.0	24	Dist.H.T.	Gen.Arm.,Term.insideI.C.,Bott.Cover	DashCont.	—	—	——
Cadillac V8-61	1939	P	.0125	.027	27	8.0	50						
Cadillac V8-60S	1939	P	.0125	.027	27	8.0	50						
Cadillac V8-75	1939	P	.0125	.027	30	8.0	17						

(Cont'd

*Note: Key to types of aerials: *R-"Running Board"* type; *SS-"Steel Screen"* type in roof; *W-"Wire"* type in roof.

†Note: These cars have "Turret" or "steel" tops and require an antenna mounted on the outside of the car.

‡Note: Key to Symbols: *F—"Fender"; L-F—"Left Fender"; L-W-P—"Left Windshield Pillar"; S-C—"Side Cowl"; T-F—"Top Front"; (E)—"Electrically Operated"; (M)—"Mechanically Operated"; (R)—"Rotatable"; (V)—"Vacuum Operated."*

Key to Symbols: "Amm."-*Ammeter;* "C"-*Coil;* "Dist."-*Distributor;* "D.L."-*Dome Light;* "E.C."-*Electric Clock;* "F.B."-*Fuse Block;* "F.W."-*Front Wheels;* "Gen."-*Generator;* "G.G."-*Gasoline Gauge;* "H.T."-*High Tension;* "I.C."-*Ignition Coil;* "I.S."-*Ignition Switch;* "Muff."-*Muffler;* "O.G."-*Oil Gauge;* "Reg."-*Regulator;* "Rel."-*Relay;* "R.S."-*Rear Springs;* "R.-W."-*Rear Wheels;* "S.C."-*Steering Column;* "S.M."-*Starting Motor;* "S.P."-*Spark Plugs;* "Transm."-*Transmission;* "T.T."-*Torque Tube;* "W.-T."-*Water Thermometer.*

Make & Model of Car	*Year*	*Batt. Term. Grounded*	*Correct Breaker Gap (Inches)*	*Correct Spark Plug Gap (Inches)*	*Generator max. normal charging rate*			*Install a Suppressor Resistor in: (Lead)*	*Connect a By-pass Condenser between Gnd. and:*	*"Bond" or "Ground" the:*	*Built-in Antenna Provided in Car:**	*Built-in Ant. Lead-in Located at:*	*External Ant. Type & Location Recommended by Car Mnf'r:‡*
					Amps. (Hot)	*Volts*	*Car Speed*						
Cadillac V16-90	1939	P	.0125	.032	26	7.4	17						
Cadillac V8, 61	1938	P	.013	.025	29	7.4	50	Dist.,S.P.	Gen.,I.C.,E.C.	F.W.	Not†		
Cadillac V8, 60'S	1938	P	.013	.025	29	7.4	50	Dist.,S.P.	Gen.,I.C.,E.C.	F.W.	Not†		
Cadillac V8, 75	1938	P	.013	.025	30	7.4	17	Dist.,S.P.	Gen.,I.C.,E.C.	F.W.	Not†		
Cadillac V16	1938	P	.013	.025	30	7.4	17	Dist.,S.P.	Gen.,I.C.,E.C.	F.W.	Not†		
Cadillac V8, 60	1937	P	.013	.025	30	8.0	51	Dist.,S.P.	Gen.,I.C.,E.C.	F.W.	Not†		
Cadillac V8, 65, 70	1937	P	.013	.025	26	8.0	20	Dist.,S.P.	Gen.,I.C.,E.C.		Not†		
Cadillac V8, 75	1937	P	.013	.025	26	8.0	20	Dist.,S.P.	Gen.,I.C.,E.C.		Not†		
Cadillac V12	1937	P	.018	.025	26	8.0	20	Dist.,S.P.	Gen.,I.C.,E.C.		Not†		
Cadillac V16	1937	P	.014	.025	26	8.0	20	Dist.,S.P.	Gen.,I.C.,E.C.		Not†		
Cadillac V8, 60	1936	P	.013	.025				Dist.,S.P.	Gen.,I.C.,E.C.,D.L.		Not†		
Cadillac V8, 70, 75	1936	P	.013	.025				Dist.,S.P.	Gen.,I.C.,E.C.,D.L.	F.W.	Not†		
Cadillac V12	1936	P	.018	.025				Dist.,S.P.	Gen.,I.C.,E.C.,D.L.	F.W.	Not†		
Cadillac V16	1936	P	.014	.025				Dist.,S.P.	Gen.,I.C.,E.C.,D.L.	F.W.	Not†		
Cadillac V8, 65	1935	P	.013	.025				Dist.,S.P.	Gen.,I.C.,S.M.	F.W.	Yes	Left	
Cadillac V12	1935	P	.018	.025				Dist.,S.P.	Gen.,I.C.,S.M.		Yes	Left	
Cadillac V16	1935	P	.014	.025				Dist.,S.P.	Gen.,I.C.,S.M.		Yes	Left	
Cadillac V8	1934	P	.013	.025				Dist.,S.P.	Gen.,I.C.,S.M.		Yes		
Cadillac V12	1934	P	.018	.025				Dist.,S.P.	Gen.,I.C.,S.M.		Yes		
Cadillac V16	1934	P	.014	.028				Dist.,S.P.	Gen.,I.C.,S.M.		Yes		
Cadillac V8	1933	P	.018	.025				Dist.,S.P.	Gen.,I.C.,S.M.		Yes	Right	
Cadillac V12	1933	P	.018	.025				Dist.,S.P.	Gen.,I.C.,S.M.		Yes	Right	
Cadillac V16	1933	P	.014	.028				Dist.,S.P.	Gen.,I.C.,S.M.		Yes	Right	
Chevrolet 6	1942	N	.018	.040	34	8.0	25	Dist.H.T.	Gen.Armature,I.S.,Amm.	F.W.,Muff.			L-W-P,orS-C
Chevrolet 6	1941	N	.018	.040	34	8.0	25	Dist.H.T.	Gen.Armature,I.S.,Amm.	F.W.,Muff.			L-W-P,orS-C
Chevrolet Master 85	1940	N	.021	.040	35	8.0	28	Dist.H.T.	Gen.Armature,I.S.,Amm.	F.W.,Muff.,Engine			
Chevrolet DeLuxe	1940	N	.021	.040	35	8.0	25	Dist.H.T.	Gen.Armature,I.S.,Amm.	F.W.,Muff.,Engine			
Chevrolet Master 6	1939	N	.021	.040	26	8.0	43	Dist.	Gen.,Amm.				
Chevrolet DeLuxe 6	1939	N	.021	.040	26	8.0	38	Dist.	Gen.,Amm.				
Chevrolet Master 6	1938	N	.021	.040	26	8.0	43	Dist.	Gen.,Amm.	Eng.,F.W.,Muff.	Not†		
Chevrolet DeLuxe 6	1938	N	.021	.040	26	8.0	38	Dist.	Gen.,Amm.	Eng.,F.W.,Muff.	Not†		
Chevrolet Master 6	1937	N	.018	.040	18	8.2	33	Dist.	Gen.,Amm.	Wheels,Muff.	Not†		
Chevrolet De Luxe 6	1937	N	.018	.040	18	8.2	29	Dist.	Gen.,Amm.	Wheels,Muff.	Not†		
Chevrolet Std. 6	1936	N	.018	.032				Dist.	Gen.,Amm.	FW.,RW.	Not†		
Chevrolet Mast. 6	1936	N	.018	.032				Dist.	Gen.,Amm.	FW.,RW.	Not†	Left	
Chevrolet Std. 6	1935	N	.021	.032				Dist.	Gen.,Amm.,D.L.		Yes	Left	
Chevrolet Mast. 6	1935	N	.021	.032				Dist.	Gen.,Amm.,D.L.		Yes	Left	
Chevrolet Std. 6, 33	1934	N	.018	.032							No	Left	
Chevrolet Mast. 6	1934	N	.018	.032							Yes		
Chevrolet	1933	N	.018	.032							Yes		
Chrysler 6	1942	P	.020	.025	34	8.0	25	Dist.H.T.	Gen.Arm.,I.S.,G.G.	DashControls			T-F,orS-C
Chrysler 8	1942	P	.017	.025	34	8.0	26	Dist.H.T.	Gen.Arm.,I.S.,G.G.	DashControls			T-F,orS-C
Chrysler Royal 6	1941	P	.020	.025	34	8.0	24	Dist.H.T.	Gen.Arm.,G.G.	DashControls			T-F,orS-C
Chrysler 8 NewYorker	1941	P	.020	.025	34	8.0	23	Dist.H.T.	Gen.Arm.,G.G.	DashControls			T-F,orS-C
Chrysler Crown Imp. 8	1941	P	.018	.025	34	8.0	26	Dist.H.T.	Gen.Arm.,G.G.	DashControls			T-F,orS C
Chrysler Royal 6, C25	1940	P	.020	.025	35	8.0	24	Dist.H.T.	Gen.Arm.,G.G.	Hood,DashControls			
Chrysler 8, C26	1940	P	.018	.025	35	8.0	26	Dist.H.T.	Gen.Arm.,G.G.	Hood,DashControls			
Chrysler Imp. 8, C27	1940	P	.018	.025	35	8.0	26	Dist.H.T.	Gen.Arm.,G.G.	Hood,DashControls			
Chrysler Royal 6	1939	P	.020	.025	28	8.0	22						
Chrysler Imp. 8	1939	P	.018	.025	28	8.0	20						
Chrysler Cust. Imp. 8	1939	P	.018	.025	28	8.0	20						
Chrysler Royal 6	1938	P	.020	.025	28	8.0	22	Dist.	Gen.,Amm.orI.S.	Controls	No		
Chrysler Imp. 8	1938	P	.018	.025	28	8.0	20	Dist.	Gen.,Amm.orI.S.	Controls	No		
Chrysler Cust. Imp. 8	1938	P	.018	.025	28	8.0	20	Dist.	Gen.,Amm.orI.S.	Controls	No		
Chrysler Royal 6	1937	P	.020	.025	22	8.0	17	Dist.	Gen.,Amm.orI.S.	Controls	No		
Chrysler Imperial 8	1937	P	.018	.025	28	8.0	16	Dist.	Gen.,Amm.orI.S.	Controls	No		
Chrysler Cust. Imp. 8	1937	P	.018	.025	28	8.0	16	Dist.	Gen.,Amm.orI.S.	Controls	No		
Chrysler Airflow 8	1937	P	.018	.025	28	8.0	16	Dist.	Gen.,D.L.,Amm.orI.S.	Controls,S.C.	Yes	Left	
Chrysler 6	1936	P	.020	.025				Dist.,S.P.	Gen.,D.L.,Amm.orI.S.	Controls,S.C.	Yes(SS)	Left	
Chrysler DL. 8	1936	P	.018	.025				Dist.,S.P.	Gen.,D.L.,Amm.	S.C.,Controls	Yes(SS)	Left	
Chrysler AF. 8	1936	P	.018	.025				Dist.,S.P.	Gen.,D.L.,Amm.	S.C.,Controls	Yes(SS)	Left	
Chrysler Imp. 8	1936	P	.018	.025				Dist.,S.P.	Gen.,D.L.,Amm.	S.C.,Controls	Yes(SS)	Left	
Chrysler 6AS	1935	P	.020	.025				Dist.,S.P.	Gen.,D.L.,I.S.		Yes	Right	
Chrysler 8AS	1935	P	.018	.025				Dist.,S.P.	Gen.,D.L.,I.S.		Yes	Right	
Chrysler 8AF	1935	P	.018	.025				Dist.,S.P.	Gen.,D.L.,I.S.		Yes	Right	
Chrysler Imp. 8AF	1935	P	.018	.025				Dist.,S.P.	Gen.,D.L.,I.S.		Yes	Right	
Chrysler IC8AF-137	1935	P	.018	.025				Dist.,S.P.	Gen.,D.L.,I.S.		Yes	Right	
Chrysler IC8AF-146	1935	P	.018	.025				Dist.,S.P.	Gen.,D.L.,I.S.		Yes	Right	
Chrysler 6	1934	P	.020	.025				Dist.,S.P.	Gen.,D.L.,I.S.		Yes		
Chrysler 8	1934	P	.018	.025				Dist.,S.P.	Gen.,D.L.,I.S.		Yes		
Chrysler Imp. 8	1934	P	.018	.025				Dist.,S.P.	Gen.,D.L.,I.S.		Yes		
Chrysler Imp. Cust. 8	1934	P	.018	.025				Dist.,S.P.	Gen.,D.L.,I.S.		Yes		
Chrysler 6	1933	P	.020	.025				Dist.,S.P.	Gen.,D.L.,I.S.		Yes		

(Cont'd over)

***Note:** Key to types of aerials: *R-"Running Board"* type; *SS-"Steel Screen"* type in roof; *W-"Wire"* type in roof.

†Note: These cars have "Turret" or "steel" tops and require an antenna mounted on the outside of the car.

‡Note: Key to Symbols: *F—"Fender"; L-F—"Left Fender"; L-W-P—"Left Windshield Pillar"; S-C—"Side Cowl"; T-F—"Top Front"; (E)—"Electrically Operated"; (M)—"Mechanically Operated"; (R)—"Rotatable"; (V)—"Vacuum Operated."*

Key to Symbols: "Amm."-*Ammeter;* "C"-*Coil;* "Dist."-*Distributor;* "D.L."-*Dome Light;* "E.C."-*Electric Clock;* "Eng."-*Engine;* "F.B."-*Fuse Block;* "F.W."-*Front Wheels;* "Gen."-*Generator;* "G.G."-*Gasoline Gauge;* "H.T."-*High Tension;* "I.C."-*Ignition Coil;* "I.S."-*Ignition Switch;* "Muff."-*Muffler;* "O.G."-*Oil Gauge;* "Reg."-*Regulator;* "Rel."-*Relay;* "R.S."-*Rear Springs;* "R.W."-*Rear Wheels;* "S.C."-*Steering Column;* "S.M."-*Starting Motor;* "S.P."-*Spark Plugs;* "Transm."-*Transmission;* "T.T."-*Torque Tube;* "W.T."-*Water Thermometer.*

Make & Model of Car	Year	Batt. Term. Grounded	Correct Breaker Gap (Inches)	Correct Spark Plug Gap (Inches)	Generator max. normal charging rate: Amps. (Hot)	Volts	Car Speed	Install a Suppressor Resistor in: (Lead)	Connect a By-pass Condenser between Gnd. and:	"Bond" or "Ground" the:	Built-in Antenna Provided in Car:*	Built-in Ant. Lead-in Located at:	External Ant. Type & Location Recommended by Car Mnf'r:‡
Chrysler Royal 8	1933	P	.018	.025				Dist.,S.P.	Gen.,D.L.,I.S.		Yes		
Chrysler Imp. 8	1933	P	.018	.025				Dist.,S.P.	Gen.,D.L.,I.S.		Yes		
Chrysler Imp. Cust. 8	1933	P	.018	.025				Dist.,S.P.	Gen.,D.L.,I.S.		Yes		
Cord (*no longer mf'd*)													
Cord 8	1937	P	.013	.025	28	8.8	31	Dist.	Gen.,I.C.	Exh.pipe	No	—	
Cord 8	1936	P	.018	.025							Yes		—
Cord	1933	P	.018	.025							No	—	
Cunningham (*no longer mf'd*)													
Cunningham	1933	N	.018	.031							No	—	—
DeSoto 6	1942	P	.020	.025	34	8.0	25	Dist.H.T.	Gen.Arm.,I.S.,G.G.	DashControls	—	—	T-F,orS-C
DeSoto 6	1941	P	.020	.025	34	8.0	24	Dist.H.T.	Gen.Arm.,G.G.	DashControls	—	—	T-F,orS-C
DeSoto 6, (S7)	1940	P	.020	.025	35	8.0	24	Dist.H.T.	Gen.Arm.,G.G.	Hood,DashContr.	—	—	—
DeSoto 6	1939	P	.020	.025	28	8.0	22						
DeSoto 6	1938	P	.020	.025	28	8.0	22	Dist.	Gen.,Amm.orI.S.	Controls	No	—	
DeSoto 6	1937	P	.020	.025	22	8.0	17	Dist.	Gen.,Amm.orI.S.	Controls	No	—	
DeSoto AS6	1936	P	.020	.025				Dist.,S.P.	Gen.,D.L.,Amm.	S.C.,Controls	Yes(SS)	Left	—
DeSoto AF. 6	1936	P	.020	.025				Dist.,S.P.	Gen.,D.L.,Amm.	S.C.,Controls	Yes(SS)	Left	
DeSoto 6AS	1935	P	.020	.025				Dist.,S.P.	Gen.,D.L.,I.S.		Yes	Right	
DeSoto 6AF	1935	P	.020	.025				Dist.,S.P.	Gen.,D.L.,I.S.		Yes	Right	
DeSoto 6	1934	P	.018	.025							Yes		
DeSoto 6	1933	P	.020	.025							Yes		
											No	—	
Dodge 6	1942	P	.020	.025	34	8.0	25	Dist.H.T.	Gen.Arm.,I.S.,G.G.	DashControls	—	—	T-F,orS-C
Dodge 6	1941	P	.020	.025	34	8.0	24	Dist.H.T.	Gen.Arm.,G.G.	DashControls	—	—	T-F,orS-C
Dodge 6 (D14, D17)	1940	P	.020	.025	35	8.0	24	Dist.H.T.	Gen.Arm.,G.G.	Hood,DashContr.	—	—	—
Dodge 6	1939	P	.020	.025	28	8.0	22						
Dodge 6	1938	P	.020	.025	28	8.0	22	Dist.	Gen.,Amm.orI.S.	Controls	No	—	
Dodge 6	1937	P	.020	.025	22	8.0	17	Dist.	Gen.,Amm.orI.S.	Controls	No	—	
Dodge 6	1936	P	.020	.025				Dist.,S.P.	Gen.,D.L.,Amm.	S.C.,Controls	Yes(SS)	Left	
Dodge 6	1935	P	.020	.025				Dist.,S.P.	Gen.,D.L.,I.S.		Yes	Right	—
Dodge 6	1934	P	.018	.025							Yes		
Dodge 6	1933	P	.020	.025							Yes		
Dodge 8	1933	P	.020	.025							Yes		
(*No longer mf'd*)	—												
Duesenberg 8	1937	N	.018	.025	11	7.5	—	——	——	—	—	—	——
Duesenberg 8	1936	N	.018	.025							No	—	
Duesenberg 8	ALL	N	.018	.025							No	—	
(*No longer mf'd*)													
Essex, Terraplane 6	1933	N	.020	.022							No	—	
Essex, Terraplane 8	1933	N	.020	.022							No	—	—
Ford 6	1942	P	.014	.030	32	—	—	None	Ck'tBk'r.,Reg.,O.G.,Dist.L.T.Term.	None	—	—	T-F(M)
Ford V8	1942	P	.014	.025	32	—	—	None	Ck'tBk'r.,Reg.,O.G.,Dist.L.T.Term.	None	—	—	T-F(M)
Ford V8	1941	P	.014	.025	32	—	—	None	Ck'tBk'r.,Reg.,O.G.,Dist.L.T.Term.	None	—	—	T-F(M)
Ford V8 (60)	1940	P	.014	.025	32	—	—	None	Reg.,O.G.,Dist.L.T.Terminal	None	—	—	—
Ford V8 (85)	1940	P	.014	.025	32	—	—	None	Reg.,O.G.,Dist.L.T.Terminal	None	—	—	—
Ford V8-60	1939	P	.014	.025	16	—	—	None					
Ford V8-85	1939	P	.014	.025	16	—	—	None					
Ford V8, 60	1938	P	.014	.025	16	—	—	None	Gen.,O.G.,I.S.	——	No	—	——
Ford V8, 85	1938	P	.014	.025	16	—	—	None	Gen.,O.G.,I.S.	——	No	—	
Ford V8, 60	1937	P	.014	—				None	Gen.,G.G.,O.G.,I.S.	—	No	—	
Ford V8, 85	1937	P	.014	.025	12	6.2	25	None	Gen.,G.G.,O.G.,I.S.	—	No	—	
Ford V8	1936	P	.012	.025				None	Gen.,D.L.,GG,I.C.,O.G.,F.B.	—	Yes(SS)	Left	
Ford V8	1935	P	.012	.025				S.P.	Gen.,I.C.,F.B.,I.S.		Yes	Left	
Ford V8	1934	P	.015	.025							Yes		
Ford B	1933	P	.018	.027							No		
Ford V8	1933	P	.015	.025							No	—	

(Cont'd.

*Note: Key to types of aerials: *R-"Running Board"* type; *SS-"Steel Screen"* type in roof; *W-"Wire"* type in roof.

†Note: These cars have "Turret" or "steel" tops and require an antenna mounted on the outside of the car.

‡Note: Key to Symbols: *F—"Fender"; L-F—"Left Fender"; L-W-P—"Left Windshield Pillar"; S-C—"Side Cowl"; T-F—"Top Front"; (E)—"Electrically Operated"; (M)—"Mechanically Operated"; (R)—"Rotatable"; (V)—"Vacuum Operated."*

Key to Symbols: "Amm."-*Ammeter;* "C"-*Coil;* "Dist."-*Distributor;* "D.L."-*Dome Light;* "E.C."-*Electric Clock;* "F.B."-*Fuse Block;* "F.W."-*Front Wheels;* "Gen."-*Generator;* "G.G."-*Gasoline Gauge;* "H.T."-*High Tension;* "I.C."-*Ignition Coil;* "I.S."-*Ignition Switch;* "Muff."-*Muffler;* "O.G."-*Oil Gauge;* "Reg."-*Regulator;* "Rel."-*Relay;* "R.S."-*Rear Springs;* "R.-W."-*Rear Wheels;* "S.C."-*Steering Column;* "S.M."-*Starting Motor;* "S.P."-*Spark Plugs;* "Transm."-*Transmission;* "T.T."-*Torque Tube;* "W.-T."-*Water Thermometer.*

Make & Model of Car	Year	Batt. Term. Grounded	Correct Breaker Gap (Inches)	Correct Spark Plug Gap (Inches)	Generator max. normal charging rate: Amps. (Hot)	Volts	Car Speed	Install a Suppressor Resistor in: (Lead)	Connect a By-pass Condenser between Gnd. and:	"Bond" or "Ground" the:	Built-in Antenna Provided in Car:*	Built-in Ant. Lead-in Located at:	External Ant. Type & Location Recommended by Car Mnf'r:‡
(No longer mf'd)													
Franklin Olympic 6	1935	P	.020	.025							Yes		
Franklin Airman 6	1935	P	.020	.025							Yes		
Franklin V12	1935	P	.020	.025							Yes		—
(No longer mf'd)													
Graham DeLuxe (108)	1940	P	.018	.025	28	8.0	—	Dist. (Induct. type)	Gen. Armature, I.S.	None	—	—	—
Graham Sprch. (107)	1940	P	.018	.025	28	8.0	—	Dist. (Induct. type)	Gen. Armature, I.S.	None	—	—	—
Graham Hllywd(109)	1940	P	.018	.025	28	8.0	—	Dist. (Induct. type)	Gen. Armature, I.S.	None	—	—	—
Graham Special 6	1939	P	.018	.025	18	8.3	—	Dist.	Gen., I.S.				
Graham Superch. 6	1939	P	.018	.025	28	8.0	—	Dist.	Gen., I.S.				
Graham Special 6	1938	P	.018	.025	18	8.3	34	Dist.	Gen., I.S.	—	No	—	
Graham Superch. 6	1938	P	.018	.025	28	8.0	42	Dist.	Gen., I.S.	—	No	—	
Graham 6, 85	1937	P	.018	.025	15	8.0	36	Dist.	Gen., I.S.	Muff., R.S.	No	—	
Graham 6, 95	1937	P	.018	.025	18	8.3	45	Dist.	Gen., O.G., Reg., W.T., I.S.	—	Yes(SS)	Left	
Graham 6, 116	1937	P	.018	.025	22	8.3	47	Dist.	Gen., O.G., Reg., W.T., I.S.	—	Yes(SS)	Left	
Graham 6, 120	1937	P	.018	.025	22	8.3	48	Dist.	Gen., O.G., Reg., W.T., I.S.	—	Yes(SS)	Left	
Graham 6, 80, 80A	1936	P	.018	.025				Dist., S.P.	Gen., I.S.	—	No	—	
Graham 6, 90, 90A	1936	P	.018	.025				Dist., S.P.	Gen., I.S.	—	No	—	—
Graham 6, 110	1936	P	.018	.025				Dist., S.P.	Gen., I.S.	—	No	—	
Graham 6	1935	P	.018	.025				Dist., S.P.	I.S.		Yes	Left	
Graham Spc. 6	1935	P	.018	.025				Dist., S.P.	I.S.		Yes	Left	
Graham 8	1935	P	.018	.025				Dist., S.P.	I.S.		Yes	Left	
Graham Super C8	1935	P	.018	.025				Dist., S.P.	I.S.		Yes	Left	
Graham 6, 8	1934	P	.020	.025							Yes		
Graham Cust. 8	1934	P	.020	.025							Yes		
Graham Std. 6	1933	P	.020	.025							No	—	
Graham Std. Cust. 8	1933	P	.020	.025							No	—	
Graham 6	1933	P	.020	.025							No	—	
Hudson 6	1942	P	.020	.032	39	8.0	35	Dist. H.T.	Gen. Arm., I.S., G.G., Tank unit, W.T.	Hood, Eng.	—	—	T-C(v), orS-C
Hudson 8	1942	P	.017	.032	39	8.0	35	Dist. H.T.	Gen. Arm., I.S., G.G., Tank unit, W.T.	Hood, Eng.	—	—	T-C(v), orS-C
Hudson 6	1941	P	.020	.032	29	8.0	35	Dist. H.T.	Gen. Arm., I.S., G.G., Tank unit, W.T.	Hood, Eng.	—	—	T-C(v), orS-C
Hudson Super 6	1941	P	.020	.032	37	8.0	35	Dist. H.T.	Gen. Arm., I.S., G.G., Tank unit, W.T.	Hood, Eng.	—	—	T-C(v), orS-C
Hudson Commodore 6	1941	P	.020	.032	37	8.0	35	Dist. H.T.	Gen. Arm., I.S., G.G., Tank unit, W.T.	Hood, Eng.	—	—	T-C(v), orS-C
Hudson Commodore 8	1941	P	.017	.032	37	8.0	35	Dist. H.T.	Gen. Arm., I.S., G.G., Tank unit, W.T.	Hood, Eng.	—	—	T-C(v), orS-C
Hudson 6	1940	P	.020	.032	29	8.0	35	Dist. H.T.	Gen. Arm., I.S., G.G., Tank unit, W.T.	Eng.	—	—	—
Hudson Super 6	1940	P	.020	.032	37	8.0	35	Dist. H.T.	Gen. Arm., I.S., G.G., Tank unit, W.T.	Eng.	—	—	—
Hudson Commodore 6	1940	P	.020	.032	37	8.0	35	Dist. H.T.	Gen. Arm., I.S., G.G., Tank unit, W.T.	Eng.	—	—	—
Hudson Commodore 8	1940	P	.017	.032	37	8.0	35	Dist. H.T.	Gen. Arm., I.S., G.G., Tank unit, W.T.	Eng.	—	—	—
Hudson 112	1939	P	.020	.032	18	8.0	27	Dist.					
Hudson 6	1939	P	.020	.032	28	8.0	35	Dist.					
Hudson Ctr'y Club 6	1939	P	.020	.032	28	8.0	35	Dist.					
Hudson Ctr'y Club 8	1939	P	.017	.032	28	8.0	35	Dist.					
Hudson 112	1938	P	.020	.032	18	8.0	25	Dist.	Gen., G.G., W.T., I.S.	Cyl.H'd., Muff	No	—	
Hudson 6	1938	P	.020	.032	28	8.0	37	Dist.	Gen., G.G., W.T., I.S.	Cyl.H'd., Muff	No	—	
Hudson 8	1938	P	.017	.032	28	8.0	37	Dist.	Gen., G.G., W.T., I.S.	Cyl.H'd., Muff	No	—	
Hudson 6, 73	1937	P	.020	.022	22	8.0	30	Dist.	Gen., G.G., W.T.	Transm., Muff.	No	—	
Hudson 8, 74, 75	1937	P	.017	.022	22	8.0	30	Dist.	Gen., G.G., W.T.	Transm., Muff.	No	—	
Hudson 6	1936	P	.020	.022				Dist.	Gen., G.G., W.T.	Transm., Muff.	No†	—	
Hudson 8	1936	P	.020	.022				Dist.	Gen., G.G., W.T.	Transm., Muff.	No†	—	—
Hudson 6	1935	P	.020	.022				Dist., S.P.	Gen., I.C., D.L., GG, W.G.		Yes	Left	
Hudson 8	1935	P	.020	.022				Dist., S.P.	Gen., I.C., D.L., GG, W.G.		Yes	Left	
Hudson 8	1934	P	.020	.022							Yes		
Hudson Super 6	1933	N	.020	.022							No	—	
Hudson 8	1933	N	.020	.022							No	—	
See also Terraplane													
(No longer mf'd)													
Hupmobile 6, R	1939	P	.022	.029	28	8.0	34	Dist.					
Hupmobile 6, E	1939	P	.022	.029	28	8.0	35	Dist.					
Hupmobile 8, H	1939	P	.015	.029	28	8.0	34	Dist.					
Hupmobile 6	1938	P	.018	.028	28	8.0	35	Dist.	Gen., D.L., I.S.	Controls, Odv'e.	No	—	
Hupmobile 8	1938	P	.015	.028	28	8.0	34	Dist.	Gen., D.L., I.S.	Controls, Odv'e.	No	—	
Hupmobile 618	1936	P	.018	.028				Dist., S.P.	Gen., D.L.	—	Yes(SS)	Right	
Hupmobile 621	1936	P	.015	.028				Dist., S.P.	Gen., D.L.	—	Yes(SS)	Right	
Hupmobile 518	1935	P	.018	.028				Dist., S.P.	Gen., D.L., S.M.	—	Yes	Right	
Hupmobile 521	1935	P	.015	.028				Dist., S.P.	Gen., D.L., S.M.	—			
Hupmobile 527	1935	P	.020	.028				Dist., S.P.	Gen., D.L., S.M.	—			
Hupmobile 417	1934	P	.015	.025							Yes	Left	—
Hupmobile 421A	1934	P	.015	.028							Yes	Right	
Hupmobile 421J	1934	P	.015	.025							Yes	Right	

(Cont'd over)

***Note:** Key to types of aerials: *R*-"*Running Board*" type; *SS*-"*Steel Screen*" type in roof; *W*-"*Wire*" type in roof.

†Note: These cars have "Turret" or "steel" tops and require an antenna mounted on the outside of the car.

‡Note: Key to Symbols: *F*—"*Fender*"; *L-F*—"*Left Fender*"; *L-W-P*—"*Left Windshield Pillar*"; *S-C*—"*Side Cowl*"; *T-F*—"*Top Front*"; *(E)*—"*Electrically Operated*"; *(M)*—"*Mechanically Operated*"; *(R)*—"*Rotatable*"; *(V)*—"*Vacuum Operated.*"

Key to Symbols: "Amm."-*Ammeter*; "C"-*Coil*; "Dist."-*Distributor*; "D.L."-*Dome Light*; "E.C."-*Electric Clock*; "F.B."-*Fuse Block*; "F.W."-*Front Wheels*; "Gen."-*Generator*; "G.G."-*Gasoline Gauge*; "H.T."-*High Tension*; "I.C."-*Ignition Coil*; "I.S."-*Ignition Switch*; "Muff."-*Muffler*; "O.G."-*Oil Gauge*; "Reg."-*Regulator*; "Rel."-*Relay*; "R.S."-*Rear Springs*; "R.W."-*Rear Wheels*; "S.C."-*Steering Column*; "S.M."-*Starting Motor*; "S.P."-*Spark Plugs*; "Transm."-*Transmission*; "T.T."-*Torque Tube*; "W.T."-*Water Thermometer.*

Make & Model of Car	Year	Batt. Term. Grounded	Correct Breaker Gap (Inches)	Correct Spark Plug Gap (Inches)	Generator max. normal charging rate: Amps. (Hot)	Generator max. normal charging rate: Volts	Generator max. normal charging rate: Car Speed	Install a Suppressor Resistor in: (Lead)	Connect a By-pass Condenser between Gnd. and:	"Bond" or "Ground" the:	Built-in Antenna Provided in Car:*	Built-in Ant. Lead-in Located at:	External Ant. Type & Location Recommended by Car Mfr:‡
Hupmobile 422	1934	P	.020	.028							Yes		
Hupmobile 426	1934	P	.020	.028							Yes		——
Hupmobile 427	1934	P	.020	.028							Yes		
Hupmobile 321	1933	P	.015	.028							Yes		
Hupmobile 322, 326	1933	P	.020	.028							Yes		
(No longer mf'd)													
LaFayette 6	1936	P	.020	.025				Dist.	Gen.,Amm.	—	No†	—	------
LaFayette 6	1935	P	.020	.018				Dist.,S.P.	Gen.,Amm.	—	Yes	Left	
LaFayette	1934	P	.020	.018							Yes		
(No longer mf'd)													
LaSalle V8 (50, 52)	1940	P	.0125	.027	34	8.0	27	Dist.H.T.	Gen.Arm.,Terminal inside I.C.Bott.Cover	F.W.,DashContr.	—	—	——
LaSalle V8-50	1939	P	.0125	.027	27	8.0	50						
LaSalle V8	1938	P	.013	.025	28	8.0	50						
LaSalle V8	1937	P	.013	.025	28	—	48	Dist.,S.P.	Gen.,I.C.,E.C.	F.W.	No		------
LaSalle 8	1936	P	.013	.025				Dist.,S.P.	Gen.,I.C.,E.C.,D.L.	F.W.	No†		
LaSalle 8	1935	P	.018	.025				Dist.,S.P.	Gen.,I.C.,S.M.		Yes		
LaSalle 8	1934	P	.018	.025							Yes		
LaSalle	1933	P	.018	.025							Yes	—	
Lincoln Zephyr	1942	P	.014	.028	30	7.2	—	None	Ea.L.T.Dist.Term.,Ck't.Bk'r,Reg.,O.G.,G.G.,W.T.	None	—	—	LeftS-C
Lincoln Zephyr	1941	P	.014	.028	30	7.2	—	None	Ea.L.T.Dist.Term.,Ck't.Bk'r,Reg.,O.G.,G G.,W.T.	None	—	—	LeftS-C
Lincoln Zephyr	1940	P	.014	.028	30	—	—	None	Ea.L.T.Dist.Term.,Ck't.Bk'r,Reg.,O.G.,G G.,W.T.	None	—	—	— —
Lincoln V12	1940	N	.015	.025	—	—	—	None	Ea.L.T.Dist.Term.,Ck't.Bk'r,Reg.,O.G.,G G.,W.T.	None	—	—	— —
Lincoln Zephyr	1939	P	.014	.028	26	—	30						
Lincoln V12	1939	N	.015	.025	16	8.0	20						
Lincoln Zephyr	1938	P	.014	.028	26	—	30	None	Gen.,I.C.(2),O.G.,G.G.,W.T.	—	Yes	TireDoor	
Lincoln V12	1938	N	.020	.028	16	8.0	20	Dist.(2)	Gen.,I.S.,O.G.,G.G.,W.T.,D.L.	—	Yes	Left	
Lincoln Zephyr	1937	P	.014	.028	15	7.0	10	None	Gen.,I.C.(2),O.G.,G.G.,R,W.T.	—	Yes	Left	— —
Lincoln V12	1937	N	.020	.025	22	8.0	20	Dist.(2)	Gen.,I.S.,D.L.,W.T.,O.G.,G.G.	—	Yes	RearSeat	
Lincoln Zephyr	1936	P	.014	.025				None	Gen.,I.C.(2),O.G.,G.G.,WT,R	—	Yes	Left	
Lincoln V12	1936	N	.020	.025				Dist.(2)	Gen.,I.C.	—	Yes	Left	
Lincoln V12	1935	N	.020	.025				Dist.(2)		—	Yes		
Lincoln V12-136	1934	N	.020	.025							Yes		
Lincoln V12-145	1933	N	.020	.025							Yes		
(No longer mf'd)													
Marmon 16	1933	P‡	.018	.022							No	—	— —
Mercury V8	1942	P	.014	.025	32	—	—	None	Ck't.Bk'r.,Reg.O.G.,Dist.L.T.Terminal	None	—	—	T-F(M)
Mercury V8	1941	P	.014	.025	32	—	—	None	Ck't.Bk'r.;Reg.O.G.,Dist.L.T.Terminal	None	—	—	T-F(M)
Mercury V8	1940	P	.014	.025	32	—	—	None	Reg.,O.G.,Dist.L.T. Terminal	None	—	—	------
Mercury V8	1939	P	.014	.025	—	—	—					—	——
Nash Amb. 600, 6	1942	P	.020	.025	34	8.0	—	Dist.H.T.	Gen.Arm.,Amm.(non-recording terminal)	Hood	—	—	LeftS-C
Nash Amb. 8	1942	P	.017	.025	34	8.0	—	Dist.H.T.	Gen.Arm.,Amm.(non-recording terminal)	Hood	—	—	LeftS-C
Nash Amb. 600	1941	P	.018	.025	34	8.0	—	Dist.H.T.	Gen.Arm.,Amm.(non-recording terminal)	Hood	—	—	LeftS-C
Nash Amb. 6	1941	P	.020	.025	34	8.0	—	Dist.,S.P.	Gen.Arm.,Amm.(non-recording terminal)	Hood	—	—	LeftS-C
Nash Amb. 8	1941	P	.017	.025	34	8.0	—	Dist.,S.P.	Gen.Arm.,Amm.(non-recording terminal)	Hood	—	—	LeftS-C
Nash Lafayette 6	1940	P	.020	.025	35	8.0	—	Dist.H.T.	Gen.ArmatureTerminal	Hood	—	—	------
Nash Ambassador 6	1940	P	.020	.025	35	8.0	—	Dist.H.T.(2)	Gen.ArmatureTerminal	Hood	—	—	------
Nash Ambassador 8	1940	P	.017	.025	35	8.0	—	Dist.H.T.(2)	Gen.ArmatureTerminal	Hood	—	—	------
Nash LaFayette 6	1939	P	.022	.025	18	8.0	24						
Nash Ambassador 6	1939	P	.022	.025	28	8.0	24						
Nash Ambassador 8	1939	P	.015	.025	28	8.0	24						
Nash LaFayette 6	1938	P	.022	.023	28	8.0	24	Dist.	O.G.,W.T.,V.R.	—	No	—	
Nash Ambassador 6	1938	P	.022	.023	28	8.0	24	Dist.	O.G.,W.T.,V.R.	—	No	—	
Nash Ambassador 8	1938	P	.022	.023	28	8.0	24	Dist.(2)	O.G.,W.T.,V.R.	—	No	—	------
Nash LaFayette 400	1937	P	.020	.025	18	8.0	24	Dist.	Gen.Cutout	Mff.,Br.Cble.	No	—	
Nash Amb. 6	1937	P	.020	.025	18	8.0	24	Dist.	Gen.	Muffler	No	—	
Nash Amb. 8	1937	P	.020	.025	28	8.0	24	Dist.(2)	Gen.	Muffler	Yes(P)		
Nash 400	1936	P‡	.020	.025									
Nash Amb. 6	1936	P‡	.020	.025				Dist.(2)	Gen.,D.L.,I.C.	—	Yes(P)	Left	
Nash Amb. 8	1936	P‡	.020	.025				Dist.(2)	Gen.,D.L.,I.C.	—	Yes(P)	Left	
Nash Adv. 6	1935	P‡	.020	.022				Dist.,S.P.	Gen.,Amm.		Yes	Left	
Nash Adv. Amb. 8	1935	P‡	.020	.022				Dist.,S.P.	Gen.,Amm.		Yes	Left	
Nash Big 6	1934	P‡	.020	.020							Yes		
Nash Adv. 8	1934	P‡	.020	.020							Yes		

(Cont'd

*Note: Key to types of aerials: *R-"Running Board"* type; *SS-"Steel Screen"* type in roof; *W-"Wire"* type in roof.

†Note: These cars have "Turret" or "steel" tops and require an antenna mounted on the outside of the car.

‡Note: Key to Symbols: *F—"Fender"; L-F—"Left Fender"; L-W-P—"Left Windshield Pillar"; S-C—"Side Cowl"; T-F—"Top Front"; (E)—"Electrically Operated"; (M)—"Mechanically Operated"; (R)—"Rotatable"; (V)—"Vacuum Operated."*

Key to Symbols: "Amm."-*Ammeter;* "C"-*Coil;* "Dist."-*Distributor;* "D.L."-*Dome Light;* "E.C."-*Electric Clock;* "F.B."-*Fuse Block;* "F.W."-*Front Wheels;* "Gen."-*Generator;* "G.G."-*Gasoline Gauge;* "H.T."-*High Tension;* "I.C."-*Ignition Coil;* "I.S."-*Ignition Switch;* "Muff."-*Muffler;* "O.G."-*Oil Gauge;* "Reg."-*Regulator;* "Rel."-*Relay;* "R.S."-*Rear Springs;* "R.-W."-*Rear Wheels;* "S.C."-*Steering Column;* "S.M."-*Starting Motor;* "S.P."-*Spark Plugs;* "Transm."-*Transmission;* "T.T."-*Torque Tube;* "W.-T."-*Water Thermometer.*

Make & Model of Car	Year	Batt. Term. Grounded	Correct Breaker Gap (Inches)	Correct Spark Plug Gap (Inches)	Generator max. normal charging rate: Amps. (Hot)	Volts	Oper Speed	Install a Suppressor Resistor in: (Lead)	Connect a By-pass Condenser between Gnd. and:	"Bond" or "Ground" the:	Built-in Antenna Provided in Car:*	Built-in Ant. Lead-in Located at:	External Ant. Type & Location Recommended by Car Mnf'r:‡
Nash Amb. 8	1934	P‡	.020	.020							Yes		——
Nash Big 6	1933	N	.020	.018							Yes		
Nash Std. 8	1933	N	.020	.018							Yes		
Nash Spec. 8	1933	N	.020	.018							Yes		
Nash Adv. 8	1933	P	.025	.020							Yes		
Nash Amb. 8	1933	P	.025	.019							Yes		
Oldsmobile 6	1942	N	.020	.040	34	8.0	23	Dist.H.T.	Gen.ArmatureTerminal	F.W.,Muff.,Transm.	—		LeftS-C(R
Oldsmobile 8	1942	N	.015	.030	34	8.0	23	Dist.H.T.	Gen.ArmatureTerminal	F.W.,Muff.,Transm.	—		LeftS-C(R)
Oldsmobile Special 6	1941	N	.020	.040	34	8.0	23	Dist.H.T.	Gen.ArmatureTerminal	F.W.,Muff.,Transm.	—	—	LeftS-C(R)
Oldsmobile Dynamic 6	1941	N	.020	.040	34	8.0	23	Dist.H.T.	Gen.ArmatureTerminal	F.W.,Muff.,Transm.	—	—	LeftS-C(R)
Oldsmobile Custom 6	1941	N	.020	.040	34	8.0	23	Dist.H.T.	Gen.ArmatureTerminal	F.W.,Muff.,Transm.	—	—	LeftS-C(R)
Oldsmobile Special 8	1941	N	.015	.030	34	8.0	23	Dist.H.T.	Gen.ArmatureTerminal	F.W.,Muff.,Transm	—	—	LeftS-C(R)
Oldsmobile Dynamic 8	1941	N	.015	.030	34	8.0	23	Dist.H.T.	Gen.ArmatureTerminal	F.W.,Muff.,Transm.	—	—	LeftS-C(R)
Oldsmobile Custom 8	1941	N	.015	.030	34	8.0	23	Dist.H.T.	Gen.ArmatureTerminal	F.W.,Muff.,Transm.	—	—	LeftS-C(R)
Oldsmobile 6, (60)	1940	N	.020	.040	33	8.0	21	Dist.H.T.	Gen.Armature Terminal,Amm.	F.W.	—	—	——
Oldsmobile 6, (70)	1940	N	.020	.040	33	8.0	21	Dist.H.T.	Gen.Armature Terminal,Amm.	F.W.	—	—	——
Oldsmobile 8, (90)	1940	N	.015	.030	33	8.0	21	Dist.H.T.	Gen.Armature Terminal,Amm.	F.W.	—	—	——
Oldsmobile 6-60	1939	N	.020	.040	26	8.0	—	Dist.	Gen.,Amm.				
Oldsmobile 6-70	1939	N	.020	.040	26	8.0	—	Dist.	Gen.,Amm.				
Oldsmobile 8-80	1939	N	.015	.030	26	8.0	—	Dist.	Gen.,Amm.				
Oldsmobile 6	1938	N	.020	.040	28	8.0	36	Dist.	Gen.,Amm.	F.W.,Tr.,Muff.	Yes(Insul.R.)	—	
Oldsmobile 8	1938	N	.015	.030	28	8.0	—	Dist.	Gen.,Amm.	F.W.,Tr.,Muff.	Yes(Insul.R.)	—	
Oldsmobile 6	1937	N	.020	.040	20	8.6	36	Dist.	Gen.	Eng.FW.,Tr.	Yes(Insul.R)	—	
Oldsmobile 8	1937	N	.015	.030	20	8.6	42	Dist.	Gen.	same	Yes(Insul.R)	—	
Oldsmobile 6	1936	N	.020	.030				Dist.	Gen.	F.W.,Tr.,E.	No†	—	
Oldsmobile 8	1936	N	.015	.030				Dist.	Gen.	F.W.,Tr.,E.	No†	—	
Oldsmobile 6	1935	N	.018	.025				Dist.	Gen.,Amm.,D.L.		No	—	——
Oldsmobile 8	1935	N	.018	.025				Dist.	Gen.,Amm.,D.L.		No	—	
Oldsmobile 6	1934	N	.018	.025							Yes	Left	
Oldsmobile 8	1934	N	.018	.025							Yes	Left	
Oldsmobile 6	1933	N	.018	.025							Yes		
Oldsmobile 8	1933	N	.018	.025							Yes		
Packard 6	1942	P	.018	.026	34	8.0	—	Dist.H.T.	Gen.Armature,I.S.orAmm.	Hood	—	—	T-F,or,LeftS-C
Packard 8	1942	P	.017	.026	34	8.0	—	Dist.H.T.	Gen.Armature,I.S.orAmm.	Hood	—	—	T-F,or,LeftS-C
Packard 110	1941	P	.020	.027	34	8.0	—	Dist.H.T.	Gen.Armature,I.S.orAmm.	None	—	—	T-F,orLeftS-C
Packard 120	1941	P	.017	.027	34	8.0	—	Dist.H.T.	Gen.Armature,I.S.orAmm.	None	—	—	T-F,orLeftS-C
Packard Super 8	1941	P	.017	.027	34	8.0	—	Dist.H.T.	Gen.Armature,I.S.orAmm.	None	—	—	T-F,orLeftS-C
Packard 110, (1800)	1940	P	.020	.026	35	8.0	—	Dist.H.T.	Gen.Armature,I.S.orAmm.,E.C.	None	—	—	——
Packard 120, (1801)	1940	P	.017	.026	35	8.0	—	Dist.H.T.	Gen.Armature,I.S.orAmm.,E.C.	None	—	—	——
Packard Super8,(160)	1940	P	.017	.026	35	8.0	—	Dist.H.T.	Gen.Armature,I.S.orAmm.,E.C.	None	—	—	——
Packard 6	1939	P	.022	.026	26	8.0	32	Dist.					
Packard 120	1939	P	.015	.026	26	8.0	34	Dist.					
Packard Super 8	1939	P	.015	.026	28	8.0	22	Dist.					
Packard 12	1939	P	.015	.026	30	8.0	17	Dist.					
Packard 6	1938	P	.018	.026	26	8.0	—	Dist.	Gen.,I.S.,E.C.	—	No	—	
Packard 8	1938	P	.013	.026	26	8.0	31	Dist.	Gen.,I.S.,E.C.	—	No	—	
Packard Super 8	1938	P	.013	.026	28	8.0	22	Dist.	Gen.,D.L.	—	Yes	Left	
Packard 12	1938	P	.018	.026	30	8.0	17	Dist.	Gen.,D.L.	—	Yes	Left	
Packard 6	1937	P	.018	.028	18	8.0	—	Dist.	Gen.,I.S.,E.C.	Controls,S.C.	Yes	Left	
Packard 120	1937	P	.013	.028	20	8.0	—	Dist.	Gen.,I.S.,E.C.	Controls,S.C.	Yes	Left	
Packard Super 8	1937	P	.013	.028	26	8.0	—	Dist.	Gen.,Reg.,D.L.	—	Yes	Right	------
Packard 12	1937	P	.018	.028	30	8.0	—	Dist.	Gen.,Reg.,D.L.	—	Yes	Right	
Packard 120	1936	P	.018	.029				Dist.	Gen.,E.C.	—	Yes	Left	
Packard 8	1936	P	.018	.029				Dist.,S.P.	Gen.,I.S.	—	Yes	Right	
Packard Super 8	1936	P	.018	.029				Dist.,S.P.	Gen.,I.S.	—	Yes	Right	
Packard 12	1936	P	.018	.029				Dist.,S.P.	Gen.,I. C.	—	Yes	Right	
Packard 120	1935	P	.018	.025				Dist.,S.P.	Gen.,I.S.		Yes	Right	
Packard 8	1935	P	.018	.025				Dist.,S.P.	Gen.,I.S.		Yes	Right	
Packard Super 8	1935	P	.018	.025				Dist.,S.P.	Gen.,I.S.		Yes	Right	
Packard 12	1935	P	.018	.025				Dist.,S.P.	Gen.,I. C.		Yes	Right	
Packard 8	1934	P	.018	.025							Yes		
Packard Super 8	1934	P	.018	.025							Yes		
Packard 12	1934	P	.018	.025							Yes		
Packard 8	1933	P	.018	.025							Yes		
Packard Super 8	1933	P	.018	.025							Yes		
Packard 12	1933	P	.018	.025							Yes		
(No longer mf'd)													
Pierce Arrow (8)	1938	P	.018	.023				Dist.	Gen.(2),Amm.	—	No	—	
Pierce Arrow (12)	1938	P	.018	.023				Dist.	Gen.(2),Amm.	—	No	—	
Pierce Arrow 8	1937	P	.018	.022	28	8.0	—	Dist.	Gen.(2),Amm.	—	Yes(W)	Right	
Pierce Arrow 12	1937	P	.018	.022	28	8.0	—	Dist.	Gen.(2),Amm.	—	Yes(W)	Right	——

(Cont'd over)

*Note: Key to types of aerials: *R-"Running Board"* type; *SS-"Steel Screen"* type in roof; *W-"Wire"* type in roof.

†Note: These cars have "Turret" or "steel" tops and require an antenna mounted on the outside of the car.

‡Note: Key to Symbols: *F—"Fender"; L-F—"Left Fender"; L-W-P—"Left Windshield Pillar"; S-C—"Side Cowl"; T-F—"Top Front"; (E)—"Electrically Operated"; (M)—"Mechanically Operated"; (R)—"Rotatable"; (V)—"Vacuum Operated."*

Key to Symbols: "Amm."-*Ammeter;* "C"-*Coil;* "Dist."-*Distributor;* "D.L."-*Dome Light;* "E.C."-*Electric Clock;* "F.B."-*Fuse Block;* "F.W."-*Front Wheels;* "Gen."-*Generator;* "G.G."-*Gasoline Gauge;* "H.T."-*High Tension;* "I.C."-*Ignition Coil;* "I.S."-*Ignition Switch;* "Muff."-*Muffler;* "O.G."-*Oil Gauge;* "Reg."-*Regulator;* "Rel."-*Relay;* "R.S."-*Rear Springs;* "R.-W."-*Rear Wheels;* "S.C."-*Steering Column;* "S.M."-*Starting Motor;* "S.P."-*Spark Plugs;* "Transm."-*Transmission;* "T.T."-*Torque Tube;* "W.-T."-*Water Thermometer.*

Make & Model of Car	Year	Batt. Term. Grounded	Correct Breaker Gap (Inches)	Correct Spark Plug Gap (Inches)	Generator max. normal charging rate: Amps. (Hot)	Volts	Car Speed	Install a Suppressor Resistor in: (Lead)	Connect a By-pass Condenser between Gnd. and:	"Bond" or "Ground" the:	Built-in Antenna Provided in Car:*	Built-in Ant. Lead-in Located at:	External Ant. Type & Location Recommended by Car Mnf'r:‡
Pierce Arrow 8	1936	P	.018	.022				Dist.	Gen.(2),Amm.	—	Yes(W)	Left	
Pierce Arrow 1602	1936	P	.018	.022				Dist.	Gen.(2),Amm.	—	Yes(W)	Left	
Pierce Arrow 1603	1936	P	.018	.022				Dist.	Gen.(2),Amm.	—	Yes(W)	Left	
Pierce Arrow 845	1935	P	.018	.022							Yes	Left	
Pierce Arrow 1245	1935	P	.018	.022							Yes	Left	
Pierce Arrow 1255	1935	P	.018	.022							Yes	Left	
Pierce Arrow 840A	1934	P	.018	.022							Yes		
Pierce Arrow 1240A	1934	P	.018	.022							Yes		
Pierce Arrow 1248A	1934	P	.018	.022							Yes		
Pierce Arrow 836	1933	P	.018	.022							Yes		
Pierce Arrow 1236	1933	P	.018	.022							Yes		
Pierce Arrow 1242, 47	1933	P	.018	.022							Yes		
Plymouth 6	1942	P	.020	.025	34	8.0	25	Dist.H.T.	Gen.Arm.,I.S.,G.G.	DashControls	—	—	TF,orS-C
Plymouth 6	1941	P	.020	.025	34	8.0	24	Dist.H.T.	Gen.Arm.,G.G.	DashControls	—	—	TF,orS-C
Plymouth DeLuxe 6	1941	P	.020	.025	34	8.0	24	Dist.H.T.	Gen.Arm.,G.G.	DashControls	—	—	TF,orS-C
Plymouth Roadking 6	1940	P	.020	.025	35	8.0	24	Dist.H.T.	Gen.Arm.,G.G.	Hood,DashContr.	—	—	——
Plymouth DeLuxe 6	1940	P	.020	.025	35	8.0	24	Dist.H.T.	Gen.Arm.,G.G.	Hood,DashContr.	—	—	——
Plymouth Roadking 6	1939	P	.020	.025	16	8.0	25	Dist.	Gen.,Amm.,orI.S.				
Plymouth DeLuxe 6	1939	P	.020	.025	28	8.0	35	Dist.	Gen.,Amm.,orI.S.				
Plymouth 6	1938	P	.020	.025	15	8.0	25	Dist.	Gen.,Amm.,orI.S.	Controls	No	——	
Plymouth DeLuxe 6	1938	P	.020	.025	28	8.0	35	Dist.	Gen.,Amm.,orI.S.	Controls	No	——	
Plymouth 6, P3	1937	P	.020	.025	15	8.0	18	Dist.	Gen.,Amm.or.I.S.	Controls	No	—	
Plymouth 6, P4	1937	P	.020	.025	22	7.8	18	Dist.	Gen.,Amm.or.I.S.	Controls	No	—	——
Plymouth 6	1936	P	.020	.025				Dist.,S.P.	Gen.,Amm.,D.L.	—	Yes(SS)	Left	
Plymouth 6	1935	P	.020	.025				Dist.,S.P.	Gen.,D.L.,I.S.		Yes	Right	
Plymouth 6	1934	P	.020	.025							Yes		
Plymouth 6	1933	P	.020	.025							Yes		
Pontiac 6	1942	N	.020	.025	34	8.0	35	Dist.H.T.	Gen.Arm.,Radio "A" Wire (at Lighting Sw.)	Shield ht'r.hose	—	—	L-F (VorM)
Pontiac 8	1942	N	.015	.025	34	8.0	35	Dist.H.T.	Gen.Arm.,Radio "A" Wire (at Lighting Sw.)	Shield ht'r.hose	—	—	L-F (VorM)
Pontiac DeLuxe 6	1941	N	.020	.025	34	7.3	35	Dist.H.T.	Gen.Arm.,Radio "A" Wire (at Lighting Sw.)	Shield ht'r.hose	—	—	L-F (VorM)
Pontiac Strm. Cust. 6	1941	N	.020	.025	34	7.3	35	Dist.H.T.	Gen.Arm.,Radio "A" Wire (at Lighting Sw.)	Shield ht'r.hose	—	—	L-F (VorM)
Pontiac DeLuxe 8	1941	N	.015	.025	34	7.3	35	Dist.H.T.	Gen.Arm.,Radio "A" Wire (at Lighting Sw.)	Shield ht'r.hose	—	—	L-F (VorM)
Pontiac Strm. Cust. 8	1941	N	.015	.025	34	7.3	35	Dist.H.T.	Gen.Arm.,Radio "A" Wire (at Lighting Sw.)	Shield ht'r.hose	—	—	L-F (VorM)
Pontiac Spc. 6,(40-25)	1940	N	.018	.025	35	8.0	35	Dist.H.T.	Gen.Arm.,Radio "A" Wire (at Lighting Sw.)	F.W.,Eng.	—	—	——
Pontiac DL 6, (40-26)	1940	N	.018	.025	35	8.0	35	Dist.H.T.	Gen.Arm.,Radio "A" Wire (at Lighting Sw.)	F.W.,Eng.	—	—	——
Pontiac DL 8, (40-28)	1940	N	.0125	.025	35	8.0	35	Dist.H.T.	Gen.Arm.,Radio "A" Wire (at Lighting Sw.)	F.W.,Eng.	—	—	——
Pontiac Tor. 8, (40-29)	1940	N	.0125	.025	35	8.0	35	Dist.H.T.	Gen.Arm.,Radio "A" Wire (at Lighting Sw.)	F.W.,Eng.	—	—	——
Pontiac Quality 6	1939	N	.018	.025	26	8.0	42	Dist.	Gen.				
Pontiac DeLuxe 6	1939	N	.018	.025	26	8.0	42	Dist.	Gen.				
Pontiac DeLuxe 8	1939	N	.0125	.025	26	8.0	42	Dist.	Gen.				
Pontiac 6	1938	N	.018	.025	28	8.0	42	Dist.	Gen.	F.W.,Cyl.Hd.	Not†	——	
Pontiac 8	1938	N	.013	.025	28	8.0	42	Dist.	Gen.	F.W.,Cyl.Hd.	Not†	——	
Pontiac 6	1937	N	.020	.025	18	8.0	40	Dist.	Gen.	CylHd.,F.W.	Not†	—	
Pontiac 8	1937	N	.015	.025	18	8.0	40	Dist.	Gen.	CylHd.,F.W.	Not†	—	
Pontiac Master 6	1936	N	.020	.025				Dist.	Gen.	FW,RW,TT.	Not†	—	
Pontiac DL. 6	1936	N	.020	.025				Dist.	Gen.	FW,RW,TT.	Not†	—	
Pontiac DL. 8	1936	N	.018	.025				Dist.	Gen.	FW,RW,TT.	Not†	—	——
Pontiac 6	1935	N	.020	.025				Dist.,S.P.	Gen.,Amm.,D.L.		No	—	
Pontiac 8	1935	N	.018	.025				Dist.,S.P.	Gen.,Amm.,D.L.		No	—	
Pontiac 8	1934	N	.013	.022							Yes	Left	
Pontiac 8	1933	N	.013	.018							Yes	Left	
(No longer mf'd)													
Reo Flying Cloud 6	1936	N	.018	.025				Dist.,S.P.	Gen.,D.L.	Controls	Yes(SS)	Left	
Reo Flying Cloud	1936	N	.020					Dist.,S.P.	Gen.,D.L.	Controls	Yes		
Reo Royale	1936	N	.020					Dist.,S.P.	Gen.,D.L.	Controls	Yes		
Reo 6A	1935	N	.020	.025				Dist.	Gen.,Amm.,D.L.		Yes	Right	
Reo S	1935	N	.020	.025				Dist.	Gen.,Amm.,D.L.		Yes	Right	——
Reo S6	1934	N	.020	.025							No	—	
Reo Royale 8	1934	N	.020	.025							No	—	
Reo S	1933	N	.020	.025							Yes		
Reo Royale	1933	N	.020	.025							Yes		
Studebaker 6	1942	P	.020	.025	34	8.0	18	Dist.H.T.	Gen.Arm.,Install resistor at G.G.	DashCont.,S.C.,GearShift	—	—	T-F(R)
Studebaker 8	1942	P	.020	.025	34	8.0	20	Dist.H.T.	Gen.Arm.,Install resistor at G.G.	DashCont.,S.C.,GearShift	—	—	T-F(R)
Studebaker Champ. 6	1941	P	.020	.025	34	8.0	18	Dist.H.T.	Gen.Arm.,Install resistor at G.G.	S.C.,GearShift	—	—	T-F(R)
Studebaker Comm. 6	1941	P	.020	.025	34	8.0	20	Dist.H.T.	Gen.Arm.,Install resistor at G.G.	S.C.,GearShift	—	—	T-F(R)
Studebaker Pres. 8	1941	P	.020	.025	34	8.0	20	Dist.H.T.	Gen.Arm.,Dist."Batt.term."(mica cond.)	S.C.,GearShift	—	—	
Studebaker Champ. 6	1940	P	.020	.025	35	8.0	16	Dist.H.T.	Gen.Arm.,Dist."Batt.term."(mica cond.)	S.C.,DashContr.	—	—	——
Studebaker Com. 6	1940	P	.020	.025	35	8.0	17	Dist.H.T.	Gen. Armature Terminal	None	—	—	——
Studebaker Pres. 8	1940	P	.020	.025	34	8.0	22	Dist.H.T.	Gen.Arm.,Dist."Batt.term."(mica cond.)	None	—	—	——

(Cont'd

*Note: Key to types of aerials: *R-"Running Board"* type; *SS-"Steel Screen"* type in roof; *W-"Wire"* type in roof.

†Note: These cars have "Turret" or "steel" tops and require an antenna mounted on the outside of the car.

‡Note: Key to Symbols: *F—"Fender"; L-F—"Left Fender"; L-W-P—"Left Windshield Pillar"; S-C—"Side Cowl"; T-F—"Top Front"; (E)—"Electrically Operated"; (M)—"Mechanically Operated"; (R)—"Rotatable"; (V)—"Vacuum Operated."*

Key to Symbols: "Amm."-*Ammeter;* "C"-*Coil;* "Dist."-*Distributor;* "D.L."-*Dome Light;* "E.C."-*Electric Clock;* "F.B."-*Fuse Block;* "F.W."-*Front Wheels;* "Gen."-*Generator;* "G.G."-*Gasoline Gauge;* "H.T."-*High Tension;* "I.C."-*Ignition Coil;* "I.S."-*Ignition Switch;* "Muff."-*Muffler;* "O.G."-*Oil Gauge;* "Reg."-*Regulator;* "Rel."-*Relay;* "R.S."-*Rear Springs;* "R.W."-*Rear Wheels;* "S.C."-*Steering Column;* "S.M."-*Starting Motor;* "S.P."-*Spark Plugs;* "Tran sm."-*Transmission;* "T.T."-*Torque Tube;* "W.T."-*Water Thermometer.*

Make & Model of Car	Year	Batt. Term. Grounded	Correct Breaker Gap (inches)	Correct Spark Plug Gap (inches)	Generator max. normal charging rate: Amps. (Hot)	Generator max. normal charging rate: Volts	Generator max. normal charging rate: Car Speed	Install a Suppressor Resistor in: (Lead)	Connect a By-pass Condenser between Gnd. and:	"Bond" or "Ground" the:	Built-in Antenna Provided in Car:*	Built-in Ant. Lead-in Located at:	External Ant. Type & Location Recommended by Car Mnf'r:‡
Studebaker Com. 6	1939	P	.020	.025	28	8.0	21	Dist.	Gen.				
Studebaker Pres. 8	1939	P	.020	.025	30	8.0	25	Dist.	Gen.				
Studebaker Com. 6	1938	P	.020	.023	28	8.0	25	Dist.	Gen.	—	No	—	
Studebaker Pres. 8	1938	P	.020	.023	30	8.0	25	Dist.	Gen.,Distributor(mica)	Engine	No	—	
Studebaker Dict. 6	1937	P	.020	.022	18	7.8	26	Dist.	Gen.	—	No	—	
Studebaker Pres. 8	1937	P	.020	.022	26	8.0	25	Dist.	Gen.	Engine	No	—	
Studebaker Dict. 6	1936	P	.025	.023				Dist.	Gen.,Amm.	—	No	—	—
Studebaker Pres. 8	1936	P	.025	.023				Dist.	Gen.,Amm.,I.C.	Muffler	No	—	
Studebaker Dict. 6	1935	P	.020	.023				Dist.S.P.	Gen.,Amm.,D.L.		Yes	Left	
Studebaker Com. 8	1935	P	.020	.023				Dist.S.P.	Gen.,Amm.,D.L.		Yes	Left	
Studebaker Pres. 8	1935	P	.020	.023				Dist.S.P.	Gen.,Amm.,D.L.		Yes	Left	
Studebaker Dict. 6	1934	P	.020	.023							Yes		
Studebaker Com. 8	1934	P	.020	.023							Yes		
Studebaker Pres. 8	1934	P	.020	.023							Yes		
Studebaker 6	1933	P	.020	.025							Yes		
Studebaker Com. 8	1933	P	.020	.025							Yes		
Studebaker Pres. 8	1933	P	.020	.025							Yes		
Studebaker Pres. 8	1933	P	.020	.025							Yes		
(No longer mf'd)													
Stutz SV16	1935	N	.017	.025							No	—	
Stutz DV32	1935	N	.020	.022							No	—	—
Stutz SV16	1934	N	.017	.025							No	—	
Stutz DV32	1934	N	.020	.022							No	—	
(No longer mf'd)													
Terraplane 6	1938	P	.020	.032	17	8.0	35	Dist.	Gen.,W.T.,G.G.	Muff.,Transm.	No	—	
Terraplane DL 6	1938	P	.020	.032	28	8.0	37	Dist.	Gen.,W.T.,G.G.	Muff.,Transm.	No	—	
Terraplane 6, 71	1937	P	.020	.022	15	8.0	27	Dist.	Gen.,W.T.,G.G.		No	—	—
Terraplane 6, 72	1937	P	.020	.025	22	8.0	30	Dist.	Gen.,W.T.,G.G.	Muff,Transm.	No		
Terraplane 6	1936	P	.020	.022				Dist.	Gen.,W.T.,G.G.	Muff,Transm.	No†		
Terraplane 6	1934	P	.020	.022						Muff,Transm.	Yes	Left	
Terraplane 6	1933	N	.020	.022							Yes	—	
Willys Americar	1941	N	.020	.030	24	8.0	—	Dist.H.T.	Gen.Armature,O.G.lead	None	—	—	S-C
Willys Americar	1941	N	.020	.030	24	8.0	—	Dist.H.T.	Gen.Armature,O.G.lead	None	—	—	S-C
Willys 440	1940	N	.020	.030	25	8.0	—	Dist.H.T.	Gen.Armature,O.G.lead	None	—	—	
Willys 48	1939	N	.022	.025	14	8.0	25	Dist.	Gen.Armature,O.G.brown lead				
Willys 38	1938	N	.020	.025	13	8.0	25	Dist.	Gen.,G.G.,O.G.,Amm.	—	No	—	
Willys 37	1937	N	.020	.025	13	8.0	22	Dist.	G.G.,O.G.,Gen.,Amm.	—	No	—	—
Willys 77	1936	N	.018	.024							No	—	
Willys 77	1935	N	.018	.024							No		

*Note: Key to types of aerials: *R-"Running Board"* type; *SS-"Steel Screen"* type in roof; *W-"Wire"* type in roof.

†Note: These cars have "Turret" or "steel" tops and require an antenna mounted on the outside of the car.

‡Note: Key to Symbols: *F—"Fender"; L-F—"Left Fender"; L-W-P—"Left Windshield Pillar"; S-C—"Side Cowl"; T-F—"Top Front"; (E)—"Electrically Operated"; (M)—"Mechanically Operated"; (R)—"Rotatable"; (V)—"Vacuum Operated."*

Key to Symbols: "Amm."-*Ammeter*; "C"-*Coil*; "Dist."-*Distributor*; "D.L."-*Dome Light*; "E.C."-*Electric Clock*; "F.B."-*Fuse Block*; "F.W."-*Front Wheels*; "Gen."-*Generator*; "G.G."-*Gasoline Gauge*; "H.T."-*High Tension*; "I.C."-*Ignition Coil*; "I.S."-*Ignition Switch*; "Muff."-*Muffler*; "O.G."-*Oil Gauge*; "Reg."-*Regulator*; "Rel."-*Relay*; "R.S."-*Rear Springs*; "R.-W."-*Rear Wheels*; "S.C."-*Steering Column*; "S.M."-*Starting Motor*; "S.P."-*Spark Plugs*; "Transm."-*Transmission*; "T.T."-*Torque Tube*; "W.-T."-*Water Thermometer.*

END

HOW TO ELIMINATE "PERSISTENT" IGNITION-SYSTEM INTERFERENCE WITH AUTO-RADIO RECEPTION IN VARIOUS MAKES & MODELS OF CARS

IN *Section 10* of this book, a chart is presented giving in condensed quick-reference form detailed instruction data for installing auto-radio receivers and eliminating all ordinary ignition noise interference in all makes and models of American cars. This data presents what each car manufacturer and leading auto-radio specialists have found must be done in order to obtain satisfactory noise-free radio reception in each model of car. These *routine* installation practices are usually sufficient in most cars (especially the newer models of the past few years)—but many are encountered in which *additional* steps must be taken before ignition interference and other disturbances are eliminated entirely. This is especially true among the older models of cars. Such "persistent" interference is due to conditions peculiar to the particular model of car, or even to the particular *individual* car—quite often making each job of this kind an individual problem.

Since the causes which may be responsible for these conditions are so varied, a great many hours of fruitless trouble-shooting may often be spent before the exact cause of the trouble, and its remedy, are found. For this reason, the information gained by a considerable amount of experience in auto-radio installation work has been assembled here to assist service men—to save their time when attempting to remedy such stubborn cases of ignition system interference. The remedies are tabulated under the headings of the various commercial car names. These names are arranged in alphabetical order.

In each case it is assumed, of course, that the noise persists after the standard suppressor equipment, "grounding", etc., as directed in the chart in *Section 10* of this book, has already been installed on the car and the receiver is securely bolted in place and connected properly. In those cases in which the use of spark-plug and distributor suppressors actually *increases* the noise level, the fact is stated; otherwise it is understood that the standard spark-plug and distributor suppressors are recommended to be installed.

Intermittent Interference in Cars of Composite Body Construction

Intermittent interference may often be encountered in the older model cars of composite body construction (wood and metal), and is seldom in perfect timing with the firing of the spark plugs. It may easily be recognized by its erratic "popping" and "crackling".

If this interference is due to an r-f voltage produced by the interference building up in poorly-grounded sections of the metal car body, and then discharging at irregular intervals, it will be necessary to secure better grounds on the particular body sections affected. The particular parts to ground will be specified here for each car model. In some extreme cases, it is even well to secure better grounding of the car body to the chassis by flexible bonds.

Importance of Good "Grounds"

Too much cannot be said about the importance of good "grounds" if ignition interference is to be eliminated. Experience shows that many cases of "persistent" ignition interference can be cleared up effectively and permanently by doing nothing more than improving the ground connections at the following points:

(1) Receiver mounting bolts.
(2) Dome lite filter grounded to the cowl—*not to the instrument panel*
(3) Grounding *rear edges of the hood when using roof aerial*
(4) Ground the *steering column,* if necessary, especially in Chrysler cars and in cars where the distributor suppressor is omitted

When "grounding" bonds are installed, all paint should be removed thoroughly, and the connections should be clean and tight. Otherwise the bond will be ineffective, and may even result in a source of noise itself if it should happen to make poor or intermittent contact.

Obtaining more Effective By-Passing

It is also exceedingly important that all by-passing condensers make good connections. When they are mounted on a bracket or under bolts which are covered with paint or grease, the bracket or bolt should first be carefully cleaned so that the condenser will have a bright, clean contact with the metal. All leads should be kept as short and straight as possible to reduce their inductance. If these precautions are not observed, the

condenser may not be effective in by-passing undesirable r-f disturbances.

If generator interference is not eliminated when the usual by-pass condenser is installed, it may be cleared up by cleaning the commutator and reseating the brushes.

When extra electrical accessories are installed on a car, additional by-pass condensers may be required to eliminate interference they produce. Thus, if an electric clock has been installed, a condenser connected to the battery lead at the clock, and grounded to the instrument board will clear up the trouble, etc.

Wheel-Static, and Wheel-Static Collectors

Wheel static sounds somewhat like continuous heavy atmospheric static. When the car gets rolling its intensity does not vary appreciably with car speed, but it dies down noticeably when car is allowed to coast and gradually reduce its speed to a stop. Wheel static is usually strong on a cold day, and practically disappears in wet or damp weather. It is also strongest on dry concrete or asphalt pavements and hardly noticeable on gravel or dirt roads. Wheel static may be eliminated by installing wheel-static collectors in the front wheels. They serve to maintain continuous electrical contact between the wheel and the axle.

There are various types of wheel-static collectors, and the manufacturer's recommendations for the type to be used should be followed. However, regardless of the type being used, all dirt, scale and grease should be cleaned from the contact surfaces to assure a good ground connection.

Brake Static

Worn or uneven brake linings having high spots which come into contact periodically with the brake drum while the car wheels are rotating cause a form of static which is heard as a series of clicks. The frequency of these clicks depends upon the speed of the car. Brake static can often be eliminated by proper adjustment of the brake bands, but in most cases, installation of new brake lining is the only effective remedy.

Telescopic Antennas

The telescopic type of antenna used on most cars should be cleaned frequently to insure smooth operation, for an accumulation of road dirt, grit, insects, etc., on it will cause the sections to bind, making it difficult to operate up and down by means of the remote control. If it binds first make sure that all sections are perfectly straight (if they are bent back slightly, straighten them carefully). Then clean the sections carefully with carbon tetrachloride, lubricate them sparingly (excess lubricant will catch dirt again quickly), and work them gently up and down until smooth operation is obtained. Do not force them.

In some types of telescopic antennas water from rain, car washing, etc., eventually finds its way down past the lower section and into the chamber below. This may cause rumbling noises in the auto radio when the car is in motion. In most cases, it may easily be cleaned out by first unscrewing the cap on the antenna base where it fastens to the fender or cowl.

Individual Cars Present Special Problems:

It must not be supposed that every car of the same make and model will require the same treatment in every case. For example, poor bonding between certain of the metal parts of one particular car (because of paint between the bolted or riveted surfaces, loose bolts or rivets, etc.) may cause excessive noise interference in that car. Since this may be an exceptional case, it cannot be expected that all cars of that particular make and model will have the same resistance between different parts of the body and chassis, and be troubled by the same interference. For this and other similar reasons, it is sometimes found that the treatment that succeeded in minimizing the noise in one car cannot always be relied upon to produce exactly the same results in another similar car. However, in most cases, the troubles and their remedies are similar, so the information which follows should prove of great value.

All Data Compiled as Result of Experience

All of the remedies specified here have actually been employed on hundreds of cars, and represent the findings of both the author and many auto-radio specialists. In the cases of those cars which are not listed, the reader is to assume that no special characteristic troubles will arise, and that the standard interference elimination procedure outlined in the Chart in *Section 10* of this book will suffice to minimize all interference.

It is wise to try one of the suggested remedies at a time, and note the effect in each case, as often a single change is all that is necessary to minimize the noise, even though there is more than one suggestion for each make of car.

AUBURN

General: On almost all Auburn cars it may be necessary to shield the high-tension lead from the ignition coil to the distributor, bonding the shield to the lock cable. It is also necessary to bond and ground all control rods entering the car from the engine compartment, and to ground all metal floor plates.

On antenna-equipped cars, it may be necessary to install a length of shielded braid over the antenna lead-in

(Cont'd over)

up into the roof structure; the shield should be grounded to the frame with the same screw that holds the glove box in place.

Auburn 1930, 1931: Thoroughly ground (on both top and bottom(the aluminum plate which houses the distributor. Use a length of braided shield fastened to one of the motor-block bolts.

By-pass condensers are required on the ignition coil, ammeter and generator. If interference still persists, connect by-pass condensers between each of the battery terminals and the instrument panel.

Auburn 1934: The ignition coil by-pass condenser should be connected to the terminal of the coil to which the *yellow* lead is attached. It is also necessary to connect a by-pass condenser at the generator. The antenna lead-in wire should be shielded as completely as possible, so that none of the lead-in wire will be exposed behind the instrument panel. It is advisable to even cover the point where the aerial wire from the receiver is spliced to the lead-in, using a piece of shielding sleeve which fits over the regular shield and which can be slid over the splice after it is made. The ends of this shielding sleeve should be tightly taped so that it makes good contact with the rest of the shielding braid from both the lead-in and the lead from the receiver. The shield should be grounded at the point where it enters the corner post.

Also ground the windshield wiper pipe at the point where it passes through the dashboard, and insert a dome-light filter at the point where the dome-light lead enters the right front corner post. The filter may consist of a choke coil (about 12 to 20 turns of No. 18 wire wound on a ½″ or ¾″ form) connected in series with the dome-light lead and by-passed to ground with a 0.5-mfd. condenser.

In some cases, it may be necessary to eliminate the spark-plug suppressors and to include an additional by-pass condenser from one side of the ammeter to ground.

Auburn 1935: Suppressors are necessary at the spark plugs and the distributor. By-pass condensers are required at the ignition coil, ammeter and generator. The lead-in should also be carefully shielded, as outlined above for the 1934 models.

Auburn 1936: Install suppressors at the distributor and spark plugs, and by-pass condensers at the generator, ignition coil and ammeter. Install a dome-light filter as explained above for the 1934 models, grounding the filter to the bulkhead. The hood should be bonded with flexible bonding braid and grounded to the bulkhead. Connect dome lite filters in all 3 tail-light leads (which run across the top of the car and come down the left-hand front corner post.) In some cases, removal of the distributor suppressor may actually improve reception.

BUICK

General: Ground the spark-plug cover with flexible braid to the water pump nut and to the oil lines at the rear of the motor. In some cases, it may be necessary to install a copper screen enclosure from the spark-plug cover over to the distributor, enclosing all the high-tension leads in between. Both ends of this enclosure should be bonded to the motor block.

Install a dome-light switch between the ammeter and the dome light at the left-hand side of the dash. It may sometimes be necessary to shield the dome-light wire, grounding the shield at both ends. If this does not help, use a choke coil (consisting of 12 to 20 turns of No. 18 wire wound on a ½″ or ¾″ form) in series with the dome-light lead, and by-pass the choke to ground with a 0.5-mfd. condenser. Install a strip of copper screening under the toe boards and floor boards, and ground the screen to the car frame.

By-pass condensers are required on the ammeter and generator. Spark-plug suppressors may not be required in this car; they may actually increase the noise level. When plug suppressors must be used, they should be mounted under the cover plate of the engine.

Buick 1929, 1930, 1931: The windshield wiper tubing, as well as the small metal braces on both sides of the windshield, should be grounded. The lead-in wire should be grounded to the nut on the upper instrument panel bolt, and again at the top of the door post. Check for loose body at conventional points.

Buick 1933: Ground the dome lite filter on right corner post. Install by-pass condenser on dome-light switch. Ground lead-in shield at point where it enters the car post. Add a 0.5-mfd. by-pass condenser from starter relay switch located on left side of dash. Ground windshield wiper tubing at each end.

Buick 1934: The lead-in wire, which is tacked to the lower cross bar of the windshield, should be loosened and a length of shielding loom slid over it so that as much of the wire as possible is covered. The shielding loom should be grounded at the bolt on the instrument panel. At the corner post, where the lead-in passes through a plastic compound, insert a piece of tubing for shielding and slide it about an inch inside the shielding loom. Solder a pigtail from the loom to the tube.

Connect by-pass condensers to the *battery* side of the ignition coil, between the ammeter and ground, and at the generator. If interference still persists, it may be

(Cont'd)

necessary to install an additional by-pass condenser from the battery side of the generator voltage regulator.

Buick 1936: Bond the muffler to car frame with flexible bonding braid.

Buick 1938: Should interference be encountered even with the distributor suppressor and the condensers on the generator and the ignition coil working properly, it usually can be overcome by installing a body ground strap between the center floor pan and the front lug of the transmission housing. The necessary parts required for a service installation can be obtained from a Buick dealer and are furnished in package No. 1394553. It is best to use the braided ground strap specified, as one of greater length or smaller in cross-section will not prove as satisfactory.

In most cases this ground strap will function satisfactorily if installed on the *right* side of the transmission. In other cases the ground strap will be more efficient if installed on the opposite side, and in a severe case it may be necessary to install one on each side.

The proper location of this ground strap can be predetermined by grounding these same points with a large wooden handled file. The strap should be installed on the side or sides where least interference is encountered. This check should be made with the radio set tuned between stations at the point where most interference is experienced. Volume control should be set at maximum and the local-distance switch set at "Distant" position.

If the interference persists, try connecting a 0.5 or 1-mfd. by-pass condenser at the ignition coil—between the battery-side terminal and the nearest screw on the valve cover plate.

CADILLAC

General: Take the primary wire which connects the distributor to the ignition coil and remove it from the ignition wire duct. Shield this wire, and ground the shield at both ends. When a roof aerial is used, bond all pipes and control rods that enter the driver's compartment from the engine compartment.

Ground the antenna lead-in which runs from the receiver to the corner post. The shield should be grounded at the point where the lead-in enters this post.

By-pass condensers are required on the *primary* side of the ignition coil, on the generator, and on the starting motor. A by-pass condenser may or may not be required on the ammeter. If so, the usual 0.5-mfd. unit is suitable; try either side of the ammeter to ground through the condenser.

Cadillac 1933: Remove from conduit the high-tension lead to the center of the distributor, and the low-tension leads. Ground the shielding over the antenna lead-in from the receiver to the corner post at the point where the antenna enters this post. Try additional 0.5-mfd. condenser from ammeter to ground.

Cadillac 1934: Connect the lead of the by-pass condenser on the starting motor to the generator terminal of the solenoid relay of the starting motor, and ground the condenser case to one of the screws of the starting motor. Spark-plug suppressors are sometimes unnecessary on these models, as they may actually increase the noise level. Shield the antenna lead-in and install a dome-light filter where the dome-light lead enters the right front corner post, in the manner explained for the 1934 Auburn cars.

Cadillac 1935, 1936: Shield leads to ignition switch. Connect 0.25-mfd. condenser between ignition switch and ground. Connect tubular condenser from "batt" terminal of ignition coil, and ground its case to the coil case with solder. Bond muffler and transmission housing to car frame.

Cadillac 1940, 1941: Peen the distributor rotor insert to lengthen it, or install a special radio rotor bar obtainable from the nearest Cadillac Motors agency.

CHEVROLET

General: It is sometimes necessary to ground the rain spout running around the edge of the car roof. This should be grounded to a corner post, after checking the resistance of the corner post to ground to make certain that it is well grounded to the car chassis.

Grounding the windshield frame as well as the small metal braces on both sides of the windshield will be found very effective when a roof antenna is employed.

In many cases, it will be found that reversing the ignition coil primary wires will cut down interference considerably. It may also be necessary to shield the entire ignition primary circuit wiring, bonding each shield separately to the bulkhead. If interference still persists, the same should be done with the high-tension leads. The distributor rotor should also be peened carefully in order to lengthen it, thereby reducing the length of the arc.

Chevrolet 1929, 1930, 1931, 1932: In severe cases of noise, it may be necessary to bond the body to the frame, or chassis, at both sides, in the front—preferably at the bulkhead. A piece of heavy bonding braid should be used, and it should be fastened to cleaned points in both the body and the frame by self-tapping screws with washers. In extremely noisy cases, the Electrolock cable and wire should be moved and the ignition should be wired up with a switch in the *hot* lead, like the later model.

(Cont'd over)

On the 1930, 31, and 32 models, where a roof aerial is employed, install a dome-light switch at the dash between the ammeter and the dome-light lead. In some cases, it may also be necessary to shield the dome-light wire up into the door posts as far as possible. It is sometimes necessary to shield the high-tension lead between the ignition coil and the distributor housing. When this treatment does not help, a separate shielded primary lead must be run from the ignition switch to the battery, grounding the shielding at both ends. Disconnect and disregard the old primary lead from the switch to the coil. Ground steering column to dash. Ground car body to frame. Ground upper door jamb to door post.

Chevrolet 1933: The 1933 model is already equipped with a roof-antenna, but it is necessary to shield the lead-in from the receiver to a point as near the antenna as possible. This can be done by pushing a piece of braided shield over the antenna lead to the receiver. It is sometimes necessary to install a switch or choke coil in series with the dome-light circuit. The coil may consist of 12 to 20 turns of No. 18 wire wound on a ½" or ¾" form. Ground to the bulkhead.

Bond front corner posts to frame at bottom. Remove ignition coil from bulkhead, and fasten to motor, using valve inspection plate bolt for fastening it.

If noise results when a passenger is seated in front, place a sheet-metal shield plate or screen beneath floor boards where feet rest. Ground this.

For persistent generator interference, connect a ¼ to ½-mfd. by-pass condenser to *second* field wire of generator.

For stop-light noise when foot-brake is used, bridge switch with a 1-mfd. condenser, connecting from terminal-to-terminal, instead of usual terminal-to-ground.

Chevrolet 1934: It is necessary to install a dome-light filter as explained above for the 1933 models and to shield the antenna lead as completely as possible. Also connect a condenser from the battery side of the ignition switch, grounding it to the instrument panel. If interference still persists, place a piece of screen over the toe boards and under the floor mat on the right side of the car and ground it to the bulkhead. For cases of "bucking" or missing at very high or low speeds on these models, replace the suppressors with wire-wound units.

Bond front corner posts to frame at bottom.

Chevrolet 1935: Bond muffler to car frame.

Chevrolet 1936: By-pass condensers are required at the ammeter and generator, the latter requiring a "dual" type condenser mounted on the cut-out relay. The condenser case should be mounted under the screw which holds the relay bracket. One of its leads should be connected to the generator output terminal of the cut-out relay. On the Master 6 model, the other lead should be connected to the field stud to which the field supply wire is connected; on the Standard 6 model, both leads are connected to the output terminal. It may also be necessary to connect a condenser between the spring clip located at the end of the wire which contains the fuse holder on the dash control unit and the terminal on the *discharge* side of the ammeter. The condenser should be connected to the spring clip by means of a self-threading screw, and the spring connector when compressed will easily slide on over the ammeter stud.

Coil-type "static collectors" are necessary on the front, and brush-type "static collectors" are necessary on the rear wheels. In some cases, it may also be necessary to bond the muffler to the car frame.

CHRYSLER

General: It may be necessary to remove the *primary* wire (which connects the ignition coil to the breaker points on the distributor) from the metal high-tension wire duct. Shield this wire, and bond the shield to the fire-wall or motor block. The high-tension lead from the coil to the distributor may also have to be shielded, and the shield grounded to the bulkhead of the car. In some cases, it may be necessary to peen the distributor rotor in order to lengthen it and thereby reduce the length of the arc.

When a roof aerial is used, install a dome-light filter or a 0.5-mfd. condenser from dome-light lead to ground; it is sometimes advisable to install a switch on the dash between the ammeter and the dome light.

It is important that the motor block and steering column be firmly bonded to the fire-wall and chassis of the car. It may sometimes be necessary to install a metal screen under the floor mat near the receiver. This screen should be well grounded to the chassis.

On *Airflow* models, it may be difficult to find the built-in antenna lead. It is brought down the right front corner post, as usual, but is then carried several inches farther, down toward the floor inside the post and then brought out. Necessary to remove screws holding leatherette covering post, reaching behind it for wire. Sets are easily mounted on upper part of bulkhead. Care should be taken that mounting bolts do not extend over one-half inch beyond engine side of firewall as this will prevent opening and closing of hood. In most cases no bond between motor block and frame is necessary. Shield antenna lead up to 1 inch within corner post.

Chrysler 1934: The condenser case attached to the dome-light wire should be grounded to the cowl panel in front of the hood lining by drilling a ⅛" hole where

(Cont'd)

the wood overlaps, and as close to the pillar as possible. It may also be necessary to connect an additional 0.5-mfd. condenser from the ammeter to ground.

Chrysler 1936: Bond steering column, speedometer cable, oil line and temperature indicator tube to dash. Shield antenna lead-in as much as possible with braided shielding. In the *Airstream 8* model, shield the low-tension wire. Run "A" lead to switch.

Chrysler 1937: Bonding top of distributor to bottom will assist in eliminating slight motor noise present when accelerating. Bond engine at two points. Adjust gap of distributor points.

DE SOTO

General: The remedies for cases of persistent noise in De Soto cars are similar to those specified for the Chrysler, Dodge and Plymouth cars of corresponding years. Refer to these for further details.

De Soto Airflow 1936: Ground dome lite filter on *right* side of dash. Connect "A" wire to ammeter. Connect ammeter condenser on switch.

De Soto 1937: Ground the antenna cable right at cable plug connector rather than at end of the 6-inch cable shield pigtail.

DODGE

General: In some cars the ignition-switch leads must be shielded, with the shield grounded at both ends. It may also be necessary to remove the primary wire connecting the ignition coil to the breaker points, from the high-tension wire duct. This lead should be shielded, and the shield grounded at both ends to the engine block. It may also be necessary to shield the high-tension lead between the ignition coil and the distributor. Both ends of the shield must be carefully grounded. Try reversing the primary leads to the ignition coil.

If a roof aerial is employed, it may be necessary to install a switch or choke coil on the dashboard between the ammeter and the dome-lite wires. The latter may consist of 12 to 20 turns of No. 18 wire wound on a ½" or ¾" form.

By-pass condensers of about 0.5-mfd. capacity are required on the generator and the dome lite wire and should be grounded to the cowl panel in front of the hood lining by drilling a ⅛" hole where the wood overlaps, and as close to the pillar as possible. It may also be necessary to by-pass either side of the ammeter to ground. The oil-pressure and water-temperature indicator lines on the engine side of the bulkhead should be grounded.

Dodge 1934: On some of the 1934 model cars, the use of spark-plug suppressors may actually increase the noise level. However, in most cases suppressors are generally required on these models at the spark plug and distributor.

Dodge 1935: Ground dome lite filter to body—on right side. Tire static encountered in 1935 models may be eliminated by removing the tires from the wheels and removing the tire cement (dull gray in color) which is painted inside the casing over an area about 3 inches wide and 18 inches long.

Dodge 1936: Ground dome lite filter to bulkhead. Bond steering column and control cables to bulkhead where they enter passenger compartment. Shield antenna lead-in as much as possible with braided shielding. If the car uses an insulated roof as the antenna, connect a 0.00025-mfd. condenser in series with the antenna section of the gang condenser in the receiver. In some cases, it may also be necessary to bond the hoods (at shoulder) to the bulkhead.

ESSEX

General: The receiver battery connection should be made directly to the storage battery. In the majority of these cars a by-pass condenser must be installed at the ignition switch, trying it at both sides for best results.

Good bonding is essential in these cars. The steering post should be bonded to the bulkhead, and the various rods passing through the bulkhead into the engine compartment should be grounded.

The dome lite circuit should be by-passed with a 0.5-mfd. condenser to ground.

The low-tension leads and the high-tension lead to the center of the distributor should be removed from the wire duct. It may be necessary to shield these leads, and ground the shields at both ends to the motor block.

FORD (Models A and B)

General: The armored cable which carries the primary wire from the switch to the distributor should be grounded to the metal bulkhead, and the spark control-rod should be grounded to the motor block.

In some cases it may be necessary to install a dome lite switch on the dashboard between the ammeter and the dome lite wire and to shield the dome lite wires as far as possible.

In only a few instances will it be found necessary to shield the high-tension wire from the ignition coil to the distributor.

When this must be done, the shield should be grounded at both the ignition coil and distributor housings.

(Cont'd over)

The "battery" lead of the receiver should be connected directly to the storage battery.

No by-pass condenser is required on the ignition coil, though it is sometimes necessary to install a coil "suppressor" in 1933 models. This may be done by removing the coil from the bulkhead and pulling out the carbon brush and spring. Save the spring and discard the brush. Make a suppressor from a 40,000-ohm, 1-watt carbon resistor by cutting it to the same length as the original brush. Assemble this in place instead of the carbon brush, and remount the coil.

It may also be necessary to move the coil to the engine block; it may be mounted by enlarging the hole in the coil bracket. This may be done easily with a tapered reamer.

By-passing from the left terminal of the terminal block to the bulkhead, and from a low-tension coil terminal to the engine block, should also be tried in cases of extreme noise.

FORD (Model V-8)

General: It has been found that a large amount of noise is picked up in the low-tension wires (hot "A" battery leads) because of their being in the same conduit with the high-tension (spark plug) wires. Removing the low-tension wires by pulling them out of the conduit and placing them along the outside of the conduit usually helps to reduce the noise. The low-tension wires should first be unsoldered from the coil and the generator terminal lugs to allow them to be pulled out of the conduit easily, then taped to the outside of the conduit and resoldered to the lugs. (The *yellow* wire with *black* tracer goes to the generator, and the *red* wire to ignition coil.)

The dome lite wire should be shielded at least up to the door post. If a roof-type aerial is employed, the lead-in should be brought down the left-hand door post, since the dome lite wire comes down the right-hand post in most cases. It may also be necessary to by-pass the dome lite wire.

It will be found that more perfect noise suppression will be obtained if all control rods such as choke and throttle levers, etc., are grounded with flexible braid, care being taken to allow sufficient slack to permit their unhampered operation.

Hoods should be grounded, either by bonding or by brass strips inserted under the hood lacing, so when the hood is clamped down, a direct grounding contact is obtained. These brass strips are perforated, and by bending them nearly together, they fit nicely over edge of the hood, under the hood lacing.

In some instances two by-pass condensers must be installed on the generator cut-out relay, one from each terminal to ground. Very often an ordinary 8-mfd. condenser, connected directly across the battery from the fuse block to ground will aid greatly in eliminating the noise.

Because of unusual construction, the distributor suppressor must be installed in the following manner: Remove the ignition coil from the front of the motor by unscrewing the three machine screws in its base. Withdraw the carbon brush and spring from the end of the coil. Substitute a 25,000-ohm carbon resistor, removed from a standard suppressor, for the brush. Enlarge the brass bushing in the opening from which the brush and spring were removed, with a one-half inch drill so that there will be no arc from the bushing to the collector ring on the rotor shaft. Use a strip of insulating paper one-half inch wide to make a bushing to replace that portion of the brass bushing drilled away. This can be done by wrapping the insulating paper around the brush spring about twice, so that the brush is held firmly in place. The end of the brush must set squarely on the rotor shaft.

By-pass condensers connected from either low-tension coil terminal to the engine block will often help reduce interference considerably. When installing these, be sure to make the connections to clean metal surfaces on the engine block. Scrape away any paint or rust that may be encountered.

In many stubborn cases, interference may be reduced by connecting a coil (consisting of about 30 turns of No. 14 enameled wire wound on a ½-inch form) in series with the low-tension lead at the spark coil next to the distributor assembly.

Due to the extremely high level of interference from the running board of the Ford V-8, if a running board type aerial is to be used, the following method of installation may prove advantageous:

Mount the aerial, preferably under the *left* running board (driver's side of the car). Mount it so the lead-in comes off the rear end of the aerial. Ground the lead-in shield to the FRAME of the car at a point opposite the front edge of the running board aerial. Extend the aerial lead and shield it with a piece of ⅜" shielded loom. Ground this loom again at a point opposite the rear support of the running board aerial. Connect the lead-in to the aerial near its rear edge. Ground the torque tube and transmission to cross-members of the frame—using a short, heavy bond. Bond front fender and splash pan to car frame. If the aerial is mounted under the *right-hand* running board instead, ground the exhaust manifold and muffler to the car frame.

Ford V8—1933: It is desirable to run the *red* lead to the distributor and the *black-and-yellow* lead to the generator in separate shields; bond the shields together

(Cont'd)

every three inches and ground them to the copper gas line. Run the radio set battery lead under the floor mat to the battery; be careful that *no* leads are run on the engine side of the bulkhead.

If interference still persists after these precautions, try removing, from the high-tension cable duct, the two wires that connect to the coil and generator. Shield each separately, and ground the shields to the motor block and bulkhead. It may be necessary to connect additional by-pass condensers at the primary side of the ignition coil, at the fuse block, and at the ignition switch.

Ford V8—1934: The by-pass condenser to be used at the fuse block can be connected underneath the bolt which holds the loom adjacent to the fuse block. Connect the condenser lead to the terminal on either end of the fuse.

Ground motor block to frame, on left side.

It is also necessary to ground the rear edge of the hood (on both sides) with flexible bonding braid. Also install hood bonds to radiator shell on both sides at the front if necessary. In extreme cases, ground the ignition wire ducts at the hoods with short, heavy bonds, since these ducts are not sufficiently grounded through their mounting brackets.

It is advisable to use a car-top type aerial only, as interference cannot be easily eliminated with a running-board type.

Bond steering column to bulkhead.

Ford V8—1935: Connect a 1-mfd. condenser from "hot" storage battery connection on the gasoline gauge to ground. Shield hot "A" lead completely from battery to set. Shield wire from resistor connection on instrument panel to resistor, removing old wire. Ground shield to cowl, engine and body.

Connect 0.25-mfd. 100-volt condenser from oil gauge terminal to car ground. (Oil gauge mechanism is located at rear of left side of engine.) Use a 0.5-mfd. 100-volt condenser across input terminal of distributor to car ground. Use a 0.5-mfd. generator by-pass condenser. If generator interference is still present, connect this condenser from the generator (brush) side of the cut-out to car ground. Connect a 0.5-mfd. ammeter by-pass condenser, mounting it from either switch terminal to ground, or across fuse block terminal to ground (whichever produces the greatest reduction in noise).

Ground the antenna lead-in shield to the top point of the dash—or to the under side of the front pillar post by wedging or jamming it as close as possible to the point where the lead-in enters the shield.

In the De Luxe model, interference may be carried to the antenna by the dome light lead. A dome-light lead filter, or by-pass condenser, connected to the terminal near the flywheel housing will eliminate it, although in some cases it is necessary to cut the dome-light lead at the dash and install a switch.

Ford V8—1936: In the 1936 models, it is necessary to by-pass all the units stated above for the 1935 models. A special coil bracket type condenser should be used on the *primary* side of the ignition coil.

In connecting the oil gauge by-pass condenser, fasten the condenser on the transmission housing underneath the starter wire clamp, and connect the lead to the terminal of the gauge on the flywheel housing, being careful that the accelerator arm does not strike the condenser or rub the condenser lead during operation.

A condenser equipped with a special bracket should be installed on the gasoline gauge, which is located on top of the left side of the gasoline tank. Access may be had to it by opening the top of the trunk and removing the circular covering. In cars not having a trunk, access may be had by moving the rear seat back cushion forward. In coupes, it is necessary to lift the rear deck, and then the rubber mat. Then remove the sheet metal screw and the rectangular metal cover.

Fasten the dome lite condenser under the lower right mounting screw and connect the lead to the bullet connector on the dome lite wire at the pillar entrance.

Mount the condenser at the fuse block behind the dash, directly to the left of the block. A hole is provided in the dash for mounting; it is only necessary to pierce the padding. Fasten the condenser in place with a No. 10, 1½-inch long sheet metal screw. Connect the lead to the left coil resistance terminal.

In models which are not equipped with an oil gauge, it is well to ground the lead which is provided for it in the harness comprising the generator and ignition wires. In that case, a grounded "shield" is also formed for the other wires in the harness as a result of grounding this lead.

In many cases will be found that suppressors may actually increase the noise on the 1936 models.

If a running board type aerial is used under *each* running board, be sure to do a good shielding job on the cross wire which connects between one aerial and the other, as this wire will pick up a terrific amount of motor noise if it is not shielded perfectly.

Ford V8—1937: See recommendations listed for 1935 and 1936 models.

If a running board type aerial is used under *each* running board, be sure to do a good shielding job on the cross wire which connects between one aerial and the other, as this wire will pick up a terrific amount of motor noise if it is not shielded perfectly.

(Cont'd over)

If a fish-pole antenna is used, be sure to shield the lead-in completely past the rear fender.

If a door-hinge antenna is used, use two by-pass condensers on the storage battery at the generator and at the starter relay. Also ground the lead-in shield directly at the plug.

Ford V8—1940: Disconnect the aerial from the radio receiver. If interference is still heard, it is due to "radio chassis pickup." In this case fasten a 1-mfd. condenser under a bolt on the emergency brake bracket. Now try connecting it to the terminal on the circuit breaker to which the radio "A" lead is connected. If this does not reduce the interference, try connecting this condenser to the "hot" terminal of the gas gauge.

Be sure the aerial connector gland nut is tight and that the nut makes good electrical contact between the radio and the instrument board.

Now connect the aerial to the radio receiver. If interference is now picked up by the aerial, try bonding the lower end of the windshield divider strip to the instrument board.

If necessary, also try bonding the body to the frame of the car.

Also try bonding all control rods which connect to the instrument board to the cowl on the motor compartment.

It may also be necessary to bond the steering column to the instrument board.

FRANKLIN

Franklin 1930, 31, 32: In these models, the conduit carrying the ignition wires must be grounded to the bulkhead on the engine side of the dash. Also, ground the ignition coil frame to the oil line in the driver's compartment. Shield the high-tension lead from the coil to the dash, and ground the shield at the dash.

Cut the dome lite wire and install a switch on the dashboard close to the door post along which the wire passes.

GRAHAM

General: Shield the wire from the ignition coil to the ignition switch located on the steering column, and ground this shield to the bulkhead. A by-pass condenser must be connected from one terminal of the fuse block located on the bulkhead, to ground. Another by-pass condenser may be required from the ignition switch terminal nearest the left side of the car (behind the instrument panel) to ground. This ground should be made securely to the top of the cowl bar immediately behind the instrument panel.

Graham 1934: Filtering is necessary for the dome lite and the cigar lighter and clock lite which are located in the header plate. Bond the ignition manifold with short bonds to the motor block at several places, making sure that both sections are bonded. Shield the antenna lead-in well.

HUDSON*

(*See also listings under Terraplane)

Hudson 1934: Install a dual condenser on the generator, one directly on the temperature indicator at the radiator, another directly on the oil gauge connection at the bottom of the motor pan and also one on the gas gauge, directly on the top of the tank. This can be reached back on the rear seat as there is a door for access.

Also use condensers in the dome lite lead, and at the ignition coil supply lead right at the coil. It is also frequently necessary to shield the high tension lead from the coil right up to the firewall. And the low tension lead from coil to distributor should be removed from the spark plug duct and shielded. The antenna lead-in should be shielded as completely and effectively as possible.

Hudson 1935: Follow same recommendations as listed above for Hudson 1934 cars.

Hudson 1936: By-pass condensers are required at the gasoline and water gauges and at the generator. In attaching to the gasoline gauge, attach the condenser case with one of the gauge mounting screws and connect the lead to the gauge terminal. Installing at the water gauge, attach the condenser to the upper rear cap screw of the water manifold of the engine, and attach the condenser lead to the terminal of the water temperature gauge element.

Also install under the floor mat, three grounding contact springs to the front, rear and left of the floor-board opening, so that the spring fingers will make contact with the transmission control housing. Be sure to clean the paint from the floor panel and transmission tower to insure good electrical contact. Place spacers under the ground clamps and secure them to the floor-board with sheet metal screws and tapping plates.

Also install a ground strap from the front muffler bracket to the frame, being sure here, again, to scrape away the paint in order to insure good electrical contact. Bond the transmission to the frame.

In some cases, it may be necessary to install a dome lite filter or by-pass condenser. It may also be necessary in extreme cases, to bond the motor block, the hood and the headlights.

(Cont'd)

HUPMOBILE

General: The antenna lead-in on these models should be well shielded. The shielding should be pushed over the lead-in and extended up into the right-hand pillar for a few inches. Ground the shield by drilling a hole in the cowl in front of the hood lacing, and connect the shield pigtail terminal to it with an 8-32 bolt and nut.

By-pass the generator by mounting a condenser under the generator relay mounting leg, and connect the condenser lead to the "battery" side of the relay. Also connect a by-pass condenser in the dome lite lead by drilling a ⅛" hole on the left side of the cowl in front of the hood lacing, fastening the condenser under the cowl with an 8-32 nut and bolt.

LAFAYETTE

General: Fasten a condenser under the generator cut-out relay mounting screw and connect its lead to the battery terminal of the relay. Mount another condenser on the instrument board flange, and connect its lead to the *discharge* side of the ammeter.

LA SALLE

General: In these cars, the *primary* lead from the distributor to the ignition coil passes through the high-tension wire duct. This wire must be removed from the duct, and, in some instances, should be shielded, the shield being grounded at both ends.

In some of the more recent custom-built models, the installation of two dome lite filters is necessary, especially when a roof aerial is employed. These filters must be connected underneath the car, (at the junction boxes) to their respective circuits.

La Salle 1934: By-pass condensers are required on the ignition coil, generator and starting motor, and often in the ammeter circuit. Connect the lead of the by-pass condenser in the starting motor circuit to the generator terminal of the solenoid relay on the starting motor, and ground the condenser case to one of the screws holding the solenoid relay to the starting motor.

The high-tension wire between the coil and dash should be shielded and the shield grounded to the dash. In some cases, the body of the driver or a passenger in the front seat may reradiate interference to the antenna. In such cases, it is necessary to move the ignition coil to some other location, or to shield the ignition coil by installing a metal plate under it and grounding this plate securely to the instrument panel.

La Salle 1935: Mount running-board type antenna at *left* side, with lead-in to front. If noisy, reverse it bringing the lead-in to the rear of the antenna.

La Salle 1936: Mount running-board type antenna on *left* side, with lead-in to front.

Install a "tubular" type condenser at the ignition coil case, "grounding" the grounding terminals to the coil case with solder.

La Salle 1940: Peen the distributor rotor insert to lengthen it, or install a special radio rotor bar obtainable from the nearest Cadillac Motor agency.

LINCOLN

General: In these cars there are two ignition coils which are mounted on the dash in the driver's compartment. The high-tension leads pass through the dash in metal conduits to the distributor which is located on the motor. The leads from the ignition coils should be well shielded and the shields carefully bonded to the firewall. It may be necessary to remove the coils and place them in the motor compartment (under the gear-case nuts).

Because of the complex dome lite wiring, shielding is usually necessary to eliminate interference from this point. A choke coil should be installed in series with the dome lite lead and by-passed to ground by a 0.5-mfd. condenser which is well grounded.

In some instances, it may also be necessary to by-pass the dome lite feeder (at the terminal box located in back of the rear seat cushion) to the body of the car with a 0.5-mfd. condenser.

By-pass the battery terminal of each coil to the coil-mounting plate, and by-pass either terminal of the ammeter to the instrument board. A suppressor should be used at the high-tension terminal of the coil as well as at the distributor.

In the event that noise still persists, add a by-pass condenser from the brush side of the generator cut-out to ground, reverse the primary leads to one coil, and bond all rods and metal parts passing through the bulkhead to the motor block and the bulkhead.

Lincoln 1934: Shield the antenna lead-in as completely and effectively as possible. It is sometimes necessary to let the outer end of this shield "float" free, so that it grounds at the radio set case only.

Lincoln 1935: Remove from conduit low-tension lead and the high-tension lead to the center of distributor. Shield low-tension wire from coil to distributor. Ground to bulkhead all rods and metal parts running through the bulkhead. Try reversing primary leads on one coil. Try a 0.5-mfd. condenser from ammeter to ground. Try grounding the motor block to the bulkhead. Try removing ignition coils from under dash and placing them on the engine side of bulkhead.

(Cont'd over)

LINCOLN-ZEPHYR

Lincoln-Zephyr 1936: The lead-in is located at the base of the left center door pillar. Carefully carry the shielded lead-in over the propeller shaft housing, and ground the shield to the floor of the car at the base of the pillar. Put by-pass condenser at ignition switch.

By-pass condensers are necessary at the generator, both ignition coils, the oil gauge, the gasoline gauge, the water thermometer and the relay. In installing the generator condenser, remove the generator cutout relay mounting screw and fasten the condenser bracket on the cutout relay mounting lug. Connect the condenser lead to the *battery* terminal of the cutout. In installing the by-pass condensers on the distributor, use the units specially designed for this installation. The oil gauge condenser should be installed on the transmission housing underneath the starter wire clamp. The condenser lead should be connected to the terminal on the oil gauge. The water gauge by-pass condenser should be fastened underneath the top radiator shell to the body bracket bolt at the top of the radiator. Connect the condenser lead to the water gauge terminal. The coil resistor condenser should be installed under the left cut-out mounting strip and bolted to the dash. The lead should be connected to the *battery* terminal of the relay.

For severe cases of persistent interference, try bonding the exhaust pipe to the car frame.

Lincoln-Zephyr 1940: Ground the muffler tail pipe to the frame of the car at a point back of the gas tank.

If a hot-air heater is used in the car, remove and shield the low-voltage wire or switch wires, from the high-tension wire manifolds.

On the convertible model, it may be necessary to ground the shield on the aerial lead, in the back of the car—making the ground connection on the floor just in back of the front seat.

In some cars it may not be possible to entirely eliminate interference if the rear-deck lid aerial is used. Installation of a cowl-type aerial is the solution.

MERCURY

Mercury 1940: See instructions listed for Ford V8-1940.

NASH

Nash 1934: If radiation into the antenna is strong, shield the bulkhead with copper sheet or screen, bonding the shielding on both sides to the engine block. Also bond the instrument panel to the bulkhead.

Nash 1936: It is necessary to install by-pass condensers at the generator, dome lite and ignition coil. In the Ambassador 6 and 8 models, fasten the condenser under the generator cutout relay mounting screw, and connect its lead to the "battery" terminal of the relay. Install another condenser under the right door instrument board flange, and connect its lead to the dome lite wire—as close as possible to the corner post. (Note: this connection should be in the form of a splice, and must be soldered and taped.) Another condenser should be fastened under the outside ignition coil bracket, and its terminal connected to the "ammeter" side of the ignition coil.

In the Nash 400 model, fasten a condenser under the generator cutout relay mounting screw and connect its lead to the battery terminal of the relay. Mount another condenser on the instrument board flange, and connect its lead to the *discharge* side of the ammeter.

If an aerial is used under each running board, the cross-wire connecting one aerial to the other should be well shielded, or it will pick up a terrific amount of motor interference.

Nash 1937: If an aerial is used under each running board, the cross-wire connecting one aerial to the other should be well shielded, or it will pick up a terrific amount of motor interference.

OLDSMOBILE

Oldsmobile 1934: The antenna lead-in should be shielded for as long a length up the corner post as possible, but do not ground the pigtail of the shield until the set is installed. After installation, turn on the set and tune between stations with full volume. Start the engine and let it run just above idling speed. Note the noise level first with the shield ungrounded, then with the shield grounded to the nearest instrument panel bracket bolt, and finally with the shield grounded to the windshield wiper tube. If least noise is obtained with the shield ungrounded, then clip the pigtail close to the shield and tape the end to prevent its grounding. On the other hand, if the shield must be grounded, do so to the point where least noise was obtained.

Spark-plug suppressors should not be used as they may actually increase the noise level. This is one car on which proper bonding and by-passing should be used in preference to suppressors. Only one suppressor—in the distributor lead—is usually necessary.

Connect the lead of the generator by-pass condenser to the generator terminal of the cut-out relay, and by-pass the ammeter to ground.

The high-tension lead from ignition coil, and the coil itself, should be shielded and the shields grounded with

(Cont'd)

short, heavy bonding braid. Extreme care must be taken in shielding the coil, as the battery terminal of the coil is "hot." Disconnect the ignition system wire from the starter relay terminal before mounting the shield.

A shielded low-tension wire should replace the original lead from the ignition coil to the distributor. After the connections are made, a pigtail should be soldered to the shield braid at a point where the wire enters the engine compartment, as near to the grommet as possible. This pigtail should then be grounded to the dash at the nearest point, preferably by soldering.

A piece of ⅜" wide flexible copper braid 10½" to 11" long should be secured for bonding. Cut off one piece about 3½" long and bond the steering column to the dash at the point where it passes through the dash on the engine side. This bonding strip should be cut and soldered in place and cut as short as possible except for a small loop to allow for some movement between the bonded parts. The remaining length of braid should be used as a bond between the support bracket on the exhaust side of the engine immediately below the dash. It is recommended that two ⅜" holes be punched in the ends of the piece of braid and then the entire end of the braid soldered over to make a good, hard terminal. This binding strip is then to be mounted under the top bolt which mounts the exhaust pipe bracket, and the other end is secured under the top bolt securing the engine support bracket. When these bolts are removed to attach the bonding strip, care should be taken to see that all the paint is removed from the under side of the bolt head and from the area under the bolt which will be covered by the bonding strip.

If interference still persists, the dome lite circuits should be by-passed or filtered.

In some cases, the body of the driver or passengers in the front seat may re-radiate interference to the antenna. In such cases, it is necessary to move the ignition coil to a different location, or to install a metal plate about 5" x 10" under the coil, fastening it to the instrument panel securely so as to shield the bottom of the coil.

Oldsmobile 1935: By-pass condensers are necessary at the ammeter, generator and dome lite. A suppressor is also necessary at the distributor. Also connect by-pass condensers to either, or both, terminals of the stop-light switch. If interference still persists, bond the last cylinder-head to the fire wall and the aluminum stops on the door sills. Also bond the relay core and base to the bulkhead.

Many severe cases of tire static develop in this car after it has run about 5000 miles, because the springs of the rear wheel static collectors become fatigued. Replacing the rear wheel static collectors eliminates it.

Oldsmobile 1936: Connect a ground strap to the left chassis cross-member by means of a 5/16" bolt, nut, shakeproof lock-washer and 5/16" x ¾" plain washer. A hole is provided in the cross-member for this purpose. In making the connection, be sure that the surfaces are clean, and that good contact is made. The other end of the strap should be fastened under the head of one of the transmission case bolts, inserting a plain washer between the strap and the head of the bolt. Another similar ground strap should be fastened between one of the cylinder head bolts and the bolt at the top of the starting pedal bracket on the dash. Static collectors should also be installed on the front wheels, making sure that the connections are clean and that there is no grease at the contact surfaces (unless the grease has graphite mixed with it).

Oldsmobile 1940: Check to see if the heater hose is lying on top of, or too near to, the distributor cap. It should be routed to one side and beneath the distributor.

If a cowl type of antenna is used, no bonds between the transmission (and muffler) to the frame are usually necessary, but in some cases of stubborn interference installation of the bonding clears up reception.

PACKARD

General: In some cases, additional by-pass condensers must be connected from either side of the ammeter to the instrument panel. By-pass condensers are also required at the generator, ignition switch, and, perhaps, from one terminal of the ignition coil primary to ground.

The low-tension lead between the coil and the breaker arm should be shielded, and the shield grounded to the bulkhead.

Packard 120—1936: Solder the end of a braided grounding strap with an eyelet provided at the other end for grounding to the oil pressure gauge tubing, and wind the strap tightly around each of the tubes and cables coming through the dash at this point. Before winding the strap, make sure that all the points which the strap touches on the various cables around which it is wound are clean and make good electrical contact with the strap. After winding, solder the strap to the pressure gauge tubing again and ground the eyelet in the braided strap to the dash. In some cases, it may also be necessary to bond the steering column to the dash with a short lead.

Install a condenser on the generator under the outside relay mounting screw, and connect the lead to the "battery" terminal of the relay.

If low-tension noise is present, shield low-tension wire. Then install an old dome lite filter in the low-tension circuits, grounding same to motor block.

(Cont'd over)

Packard 8 and Super 8—1936: Connect a by-pass condenser at the *ammeter* side of the ignition switch, grounding it under the lower instrument light housing screw. Mount another condenser under the outside generator relay mounting screw and connect its lead to the relay *battery* terminal. The spark-plug gap should be increased from 0.025″ to 0.03″.

Bond the hoods. Use a distributor suppressor if necessary.

Packard 12—1936: Mount a condenser on the coil bracket, fastening it with the right-front coil mounting screw. Pass the condenser lead through the hole provided in the coil bracket, and connect it to the lower side of the coil, to which a brass strip is fastened. In replacing the unit, make sure that the enamel is cleaned away so the condenser case is well grounded. Fasten another condenser under the outside generator relay mounting screw, and connect its lead to the relay "battery" terminal. Resistors may or may not be necessary in the coil wires. The spark-plug gap should be increased from 0.025″ to 0.030″.

Packard 1938: If noise persists when using an under-car antenna, ground the shield from the antenna at two places. First at the bolt holding the antenna to the running board and also on the frame to which the running board is fastened. In other words, it is necessary to ground the left running board to the frame.

PIERCE-ARROW

Pierce Arrow 8 and 12—1936: Two by-pass condensers are necessary at the generator and one at the ammeter. Fasten one of the condensers under the inside generator relay leg and connect its lead to the *battery* side of the relay. The second condenser is mounted under the current-limiting relay mounting screw, and its lead should be fastened to the same terminal to which the "A" lead is connected. The ammeter by-pass condenser should be fastened to the instrument board flange, and its lead connected to the ammeter. A suppressor is also necessary at the distributor.

PLYMOUTH

General: The lead from the ignition coil should be shielded up to the metal fire-wall, and then grounded to the oil line. The oil line, in turn, should be grounded, on the motor side, to the fire-wall. It is also essential on these models to remove the primary lead between the ignition coil and the distributor from the high-tension duct. This lead should be shielded, and the shield bonded to the engine and fire-wall.

Because of the use of the rubber "floating power" engine mounting in these cars (which insulates the motor block from the frame) it is absolutely essential that the motor block be carefully grounded to the car frame by means of stout, flexible copper braid, leaving sufficient slack so as not to interfere with the normal "rocking" of the motor.

By-passing is required at the dome lite, generator and ignition switch in nearly all cases. It may also be necessary to by-pass either side of the ammeter to the instrument board.

A dome lite switch or filter should be installed close to the left-hand side of the dash when a roof antenna is employed.

Interference is sometimes caused by a sticking brush in the distributor. Remove the top of the distributor housing and drop some thin oil on the brush in order to loosen it. This may eliminate a considerable amount of noise. In some cases, bonding the speedometer cable to the chassis will eliminate a considerable amount of interference.

Plymouth 1935: Interference caused by tire static may be eliminated by removing the tires from the wheels and removing the strip of cement (dull grey in color) about 3″ wide and 18″ long which is painted inside the casing. Remove with a wire buffer and benzine.

Plymouth 1936: Ground the dome lite filter to body. Ground lead-in shield to cowl. Ground steering column at bracket on dash—also where column enters bulkhead. Bond speedometer cable, oil line and temperature indicator tube to dash.

Plymouth 1937: Ground hood by removing the third screw from center holding the webb tape, and installing a brass or bronze grounding spring there.

PONTIAC

General: Shield the high-tension lead from the ignition coil to the fire-wall, and ground the shield to the fire-wall.

Remove the low-tension lead (which connects the coil to the distributor) from the high-tension wire-duct. Rearrange this lead behind the conduit alongside the motor block.

If a roof aerial is employed, a dome lite filter is necessary to eliminate pick-up from the dome lite and leads.

If running board aerial is used, bond the running board and fender on the side the aerial is used on.

It is necessary that the ammeter, dome lite, and generator be by-passed in these cars. The lead of the generator by-pass condenser should connect to the generator terminal of the cutout relay, and the ammeter by-pass condenser should be connected to the registering terminal. In order to prevent excessive noise pickup,

(Cont'd)

it may also be necessary to carry the antenna lead-in wire under the floor boards, rather than under the dash. The use of spark-plug suppressors may actually increase interference noise.

Ground the generator and radiator shell to the same point on the motor block.

Pontiac 1936: A by-pass condenser is required at the generator, and a suppressor is required at the distributor. The generator by-pass condenser case should be mounted on the armature terminal, making sure that all paint and dirt are scraped away, so that good contact is made. Connect the condenser lead to the cover screw of the generator bearing. Do *not* connect it to the field terminal, as damage to the voltage regulator will result.

Bond the torque tube to the chassis frame, fastening the bonding strap to the web of one of the K members. Bond the transmission to the frame if necessary.

Install "static collectors" in the dust caps on the front wheels. See that the rounded contact button at the center of the helical spring is centered in the center hole of the axle shaft. File away all burrs at this hole to prevent wear at the contact point. Remove any grease from the end of the axle shaft and bend the cotter pin back against the flat of the nut to avoid interference with the collector spring.

Static collectors are also necessary on the rear wheels, but the type to be used depends upon the particular type of flange on the wheels. If the flange is square, use a "pencil type" collector. If the flange is round, use a "static collector" which is made of sheet brass and carries a carbon contact brush.

Pontiac 1940, 1941: If the car is equipped with an underseat heater, the heater hose must be shielded. Slip two pieces of braided metal loom over the hose and stretch them lengthwise until they are tight over the hose. Remove the clamp bolt from the double clip which supports the hose at the cylinder head, and scrape away all paint and dirt from between the support and the clip and between the support and the clamp bolt nut in order to obtain good grounding.

On six-cylinder cars it will be necessary to install a hose-support bracket. To do this remove the small clip support and coil wire support from the cylinder head. Scrape all paint and dirt from both sides of the supports and bracket, and from the bosses on the cylinder head. Install the bracket, and replace the supports on top of the bracket.

REO

Reo 1936: By-pass condensers are necessary at the generator and dome lite. Suppressors are necessary at the distributor and spark plugs. Fasten the generator by-pass condenser case under the screw that holds the generator cutout, and connect the condenser lead to the cutout terminal. Connect the dome lite wire condenser at the point where it enters the right windshield pillar, grounding it to the lower instrument board fastening screw. In some cases, it may be necessary to bond and ground all the metal controls that come through the large grommet in the center of the dash.

STUDEBAKER

General: Shield the high-tension lead between the ignition coil and the distributor, and ground the shield at both ends. By-passing is necessary in the ammeter, generator, and dome lite circuits. It may also be necessary to by-pass the switch wire of the coil to the coil bracket.

The metal eavestrough around the top of the car is usually a source of interference radiation, and should be bonded to the chassis frame.

Bond exhaust pipe to car frame.

Studebaker 1934: To completely eliminate motor noise it may be necessary to shield the dome lite wire from the fuse block to the right hand windshield post where it is metal covered. It should be grounded at both ends. Cover up the openings where the wire comes out on both left and right windshield posts with two metal discs about 4 inches in diameter.

Studebaker 1936 "Dictator": By-pass the generator and ammeter, and apply a suppressor to the distributor. Mount the case of the generator by-pass condenser under the relay mounting screw and connect the condenser lead to the "battery" terminal on the relay. The ammeter by-pass condenser should be mounted on the back of the speedometer, and the lead connected to one of the ammeter terminals.

Studebaker 1936 "President": By-pass condensers are necessary at the generator, ignition coil and ammeter. A suppressor is necessary in the distributor. The by-pass condensers should be connected in the same way as outlined above for the Dictator models. The ignition coil by-pass condenser should be mounted on the bottom edge of the instrument board and the lead connected to the ignition coil switch terminal. The front end of the muffler should be bonded to the car frame.

Studebaker 1937: Bond the back of the self-starter to the floor board.

Studebaker 1940: If interference is heard with the aerial disconnected from the receiver, try the following:

Dress all ignition wires as far away from the radio as possible.

Try connecting a 0.5-mfd. condenser between the grounded radio set housing and the A terminal where it enters the radio set.

Try shielding the A lead on the radio housing, and ground the shielding near the point where the A lead

(Cont'd over)

enters the radio. Make sure that the shielding does not touch other wiring in the car, and that it is dressed on the side of the radio.

Bond and ground all the controls which pass through the dash.

Now connect the aerial back to the radio receiver. Any aerial pick-up of interference may now be reduced by the following:

Slide the clip of the aerial lead either up or down on the rod and fasten in position where the least amount of interference is heard. Dress the aerial lead above the ignition lock.

An additional pigtail connected to the shield in the center of the aerial lead and grounding the pigtail may reduce the interference.

Connect a piece of copper braid from the "ground" side of the battery to the motor block. The right mounting bolt of the oil filter forms a convenient point to locate this ground to the block.

It may prove helpful to connect an additional 0.5-mfd. condenser to the ignition switch.

In some stubborn cases it may be necessary to peen the rotor.

In many cases isolating the wire which is connected between the ignition coil and the terminal on the overdrive transmission has proven helpful. Disconnect and tape up both ends of this wire. Connect a shielded wire from the ignition coil to the terminal on the overdrive transmission.

The shielded wire should follow the speedometer cable all the way down to the terminal on the transmission. Ground one end of the shielding near the overdrive terminal and the other end of the shielding near the ignition coil terminal.

The side panel is fastened at the cowl to an angle bracket with one hex head bolt and one round head screw. Raise the hood and remove the bolt and screw that fastens the left side panel. Clean all the paint from the bracket underneath the bolt and screw heads to insure good electrical contact and then replace the bolt and screw.

In some cases of severe motor interference, it may be necessary to ground the gear shift and steering columns in the motor compartment at the point where they enter the body. The ground strap should be made from heavy copper braid and should be 4½ in. long. Solder one end of the strap to the both columns and the other end of the strap to the dash. There should be sufficient slack in the ground strap to permit free operation of the gear shift.

If these measures do not reduce the interference to a satisfactory low level, it may be necessary to use spark plug suppressors.

Studebaker 1941: See that the hot water hose is kept as close to the floor boards as possible, so that the interference radiation from this hose will be kept away from the aerial and receiver pickup circuits.

It may be necessary to provide an additional ground on the steering column, between the steering column and the steering column-instrument board bracket. This grounding may be accomplished by drilling a ⅛-in. hole in the column (next to the bracket) and screwing in a ⅛-in. hex head self-tapping crew, not over ¼-in. long. The head of the screw must rub against the edge of the bracket and make good electrical contact between the steering column tubing and the instrument board bracket.

There is some radiation of interference from the radiator core and the front end in some cars. A ground strap, similar to the one installed on the steering column should be connected between the front frame cross member and the radiator frame. It will be necessary to drill both the frame and the stud bar with a ⅛-in. drill and fasten the ground strap with self-tapping screws.

On some of the early-run cars the over-drive control wiring harness was located below the frame of the car at a point where it crosses to the transmission unit. This wiring harness should be so located that it is *above* the frame at all points in order to help reduce the interference field radiating from it.

It is often beneficial in stubborn cases of interference to carefully loosen all the mounting bolts on the hood hinges and side panels and remove the paint underneath the brackets and bolt heads so that good electrical contact is made there.

TERRAPLANE*

***(See also listings under Hudson)**

General: An annoying intermittent buzz is often present while the motor is running. Motor noises are carried and radiated by the gas line. If a condenser from the gas line to chassis does not remove the trouble, a satisfactory solution is to ground the gas tank, as a fabric insulates it from the hanger. An easy way to do this is to wrap a piece of copper braid around the insulating fabric and clamp the tank back in position.

Terraplane 1936: Shield high and low tension wires, and ground sheath to bulkhead. Install condenser on gas, oil, and water gauges—*at gauge.*

ZEPHYR

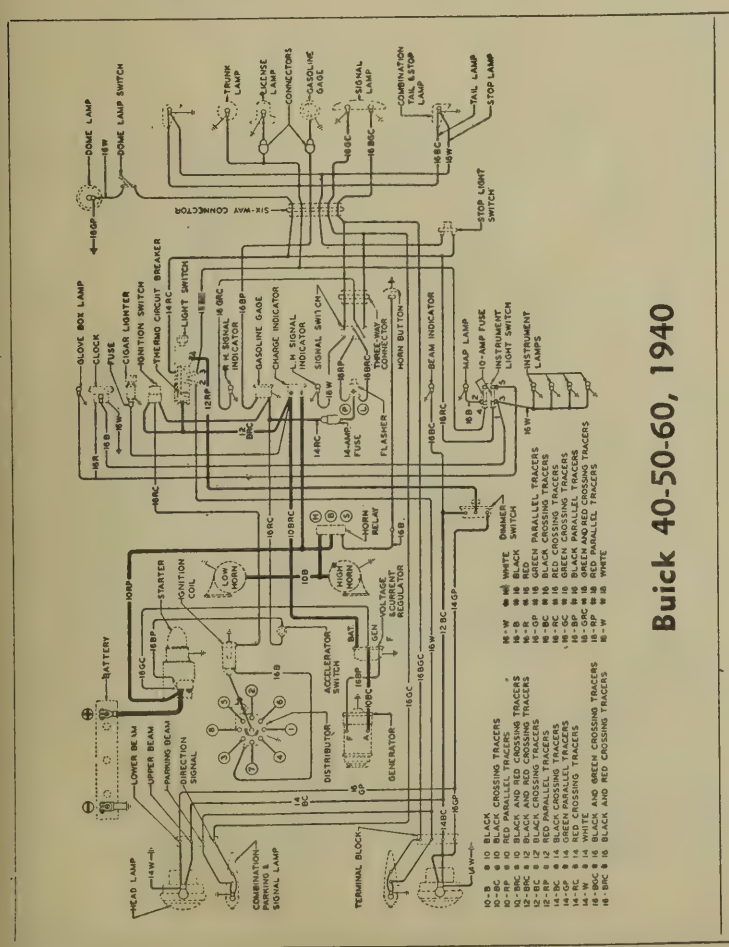
(See listings under Lincoln-Zephyr)

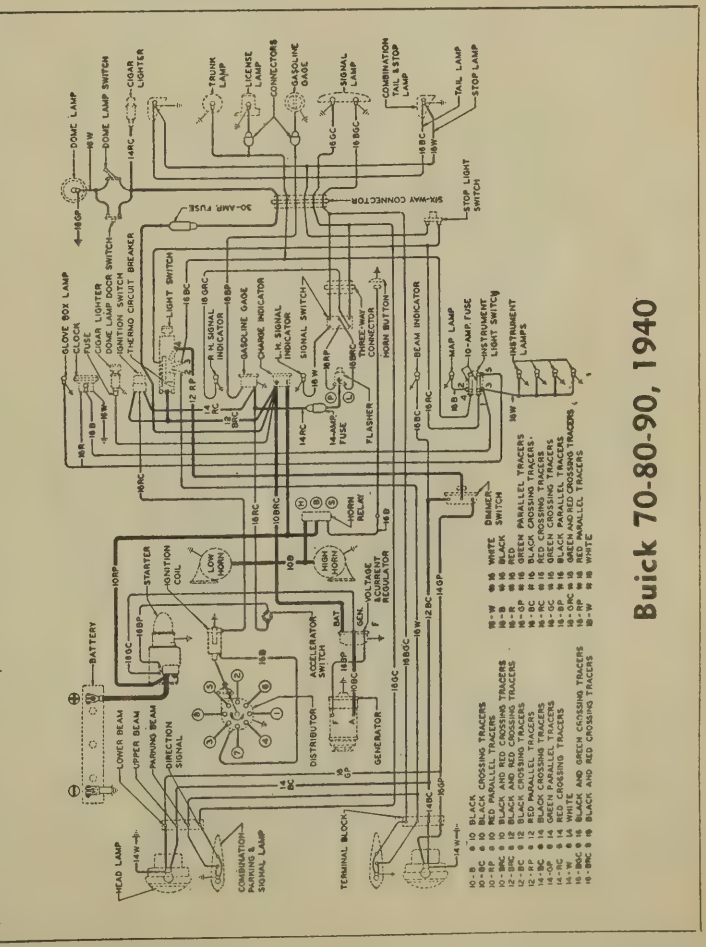
ELECTRICAL WIRING DIAGRAMS OF AUTOMOBILES

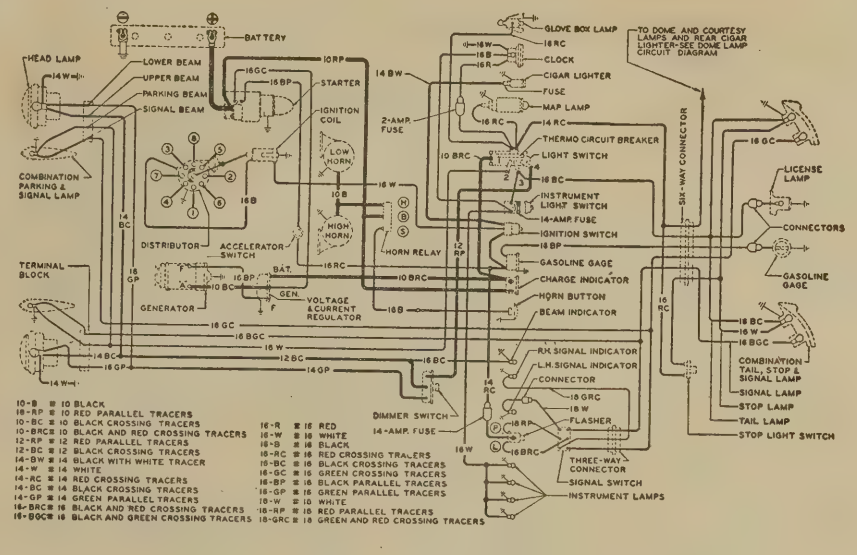
SINCE a knowledge of the electrical systems of automobiles is very important in auto-radio service work, there are shown in the following pages the diagrams of the electrical wiring systems of 88 recent models of American cars. As pointed out in the Auto-Radio Chapter of the author's book *Modern Radio Servicing,* and in *Sections 10* and *11* of this book, it is often necessary to place suitable filters in lighting leads or in some of the switching circuits to prevent interference. While the proper location of such filters may be determined by cut-and-try methods, it is very desirable to know the relative position of the filter with respect to other electrical apparatus in the car. It is the purpose of these diagrams to show these positions.

There are other uses for these diagrams. Certain pieces of electrical equipment are at ground potential and others are not; certain cars have their switches in the *negative* leads and others have them in the *positive* leads; some cars use a two-wire system and others, like the *Chevrolet,* use a single-wire system; some switches are in the "ground" side of the line and others are in the "live" lead, regardless of the polarity of the grounded terminal of the battery. By means of the diagrams shown here, these peculiarities may be ascertained for the particular car in question whenever necessary.

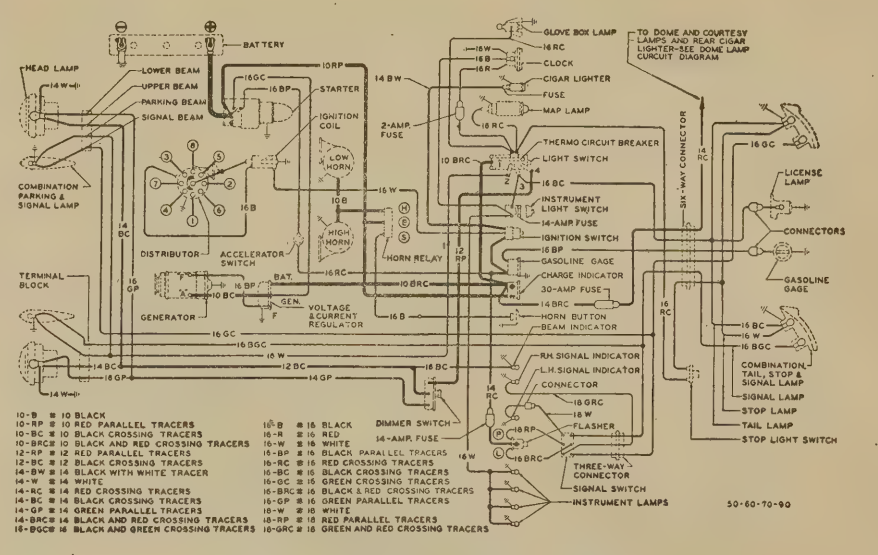
In instances where the original wiring of the car has not been changed since it left the factory, the color coding shown in the diagrams may be used to advantage, especially in those cars whose wiring systems are somewhat complicated. The leads are usually cabled, and the individual wires in the cable may be checked and selected either by means of the color code (when it is used) or by means of an ohmmeter when necessary. Diagrams of this kind will be found very helpful in the work of installing, servicing, and eliminating electrical interference in auto-radio receivers. Most of the diagrams presented here are reproduced by courtesy of *Motor,* and *Automobile Digest* magazines.



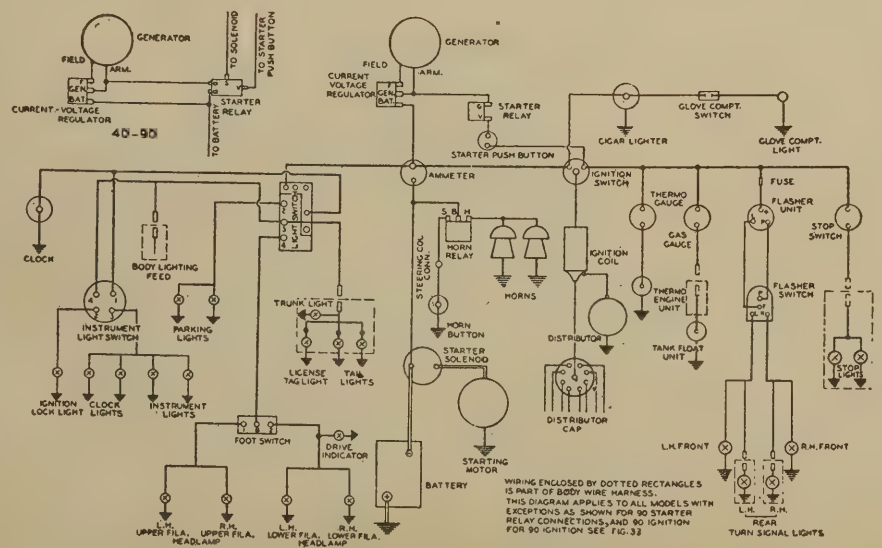




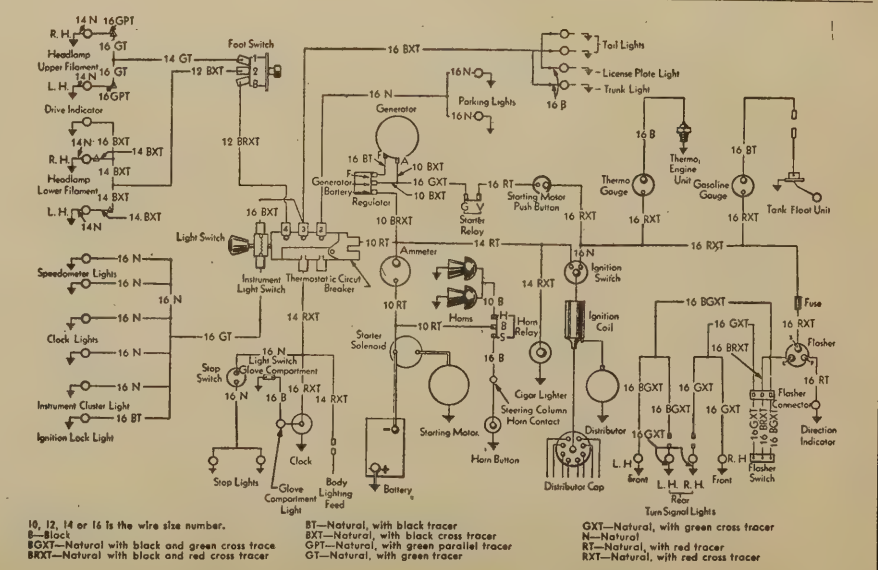
Buick 40, 1941
("Special")



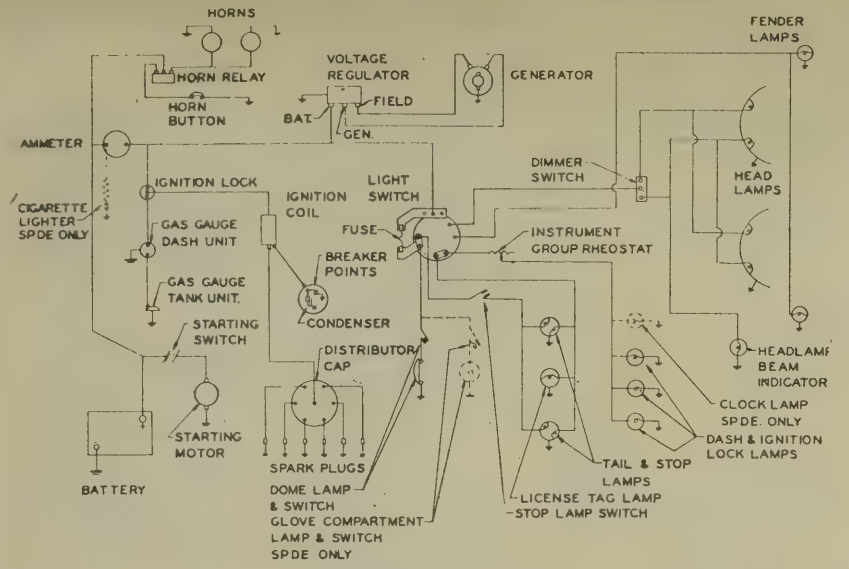
Buick 50-60-70-90, 1941
("Super", "Century", "Roadmaster", "Limited")



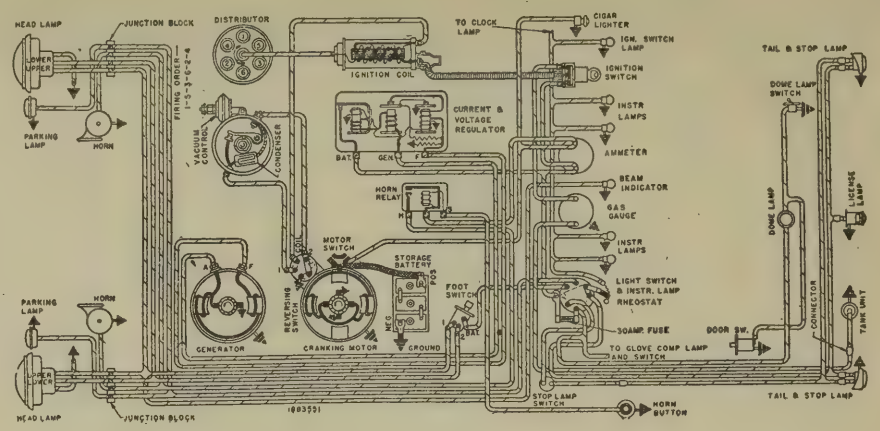
Cadillac V-8, 1940
(Series 40-60S, 62, 72, 75)



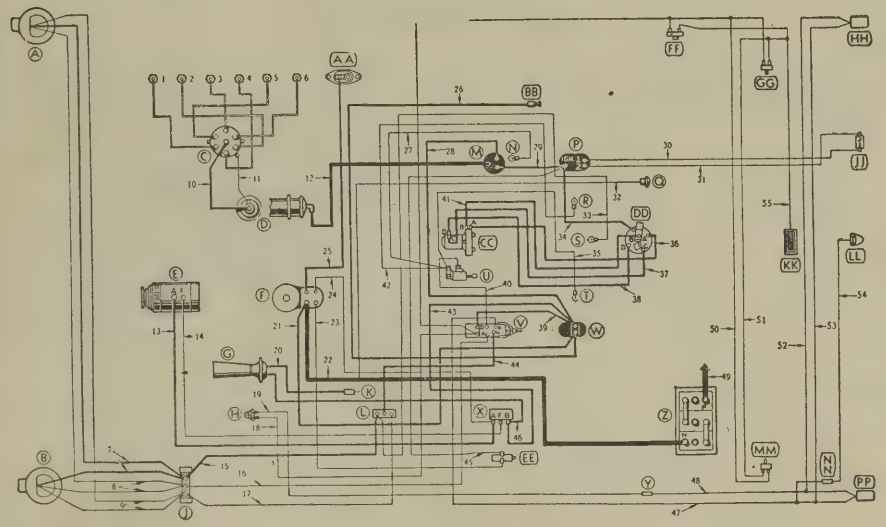
Cadillac, 1941
(Models 61, 62, 63, 67, 75)



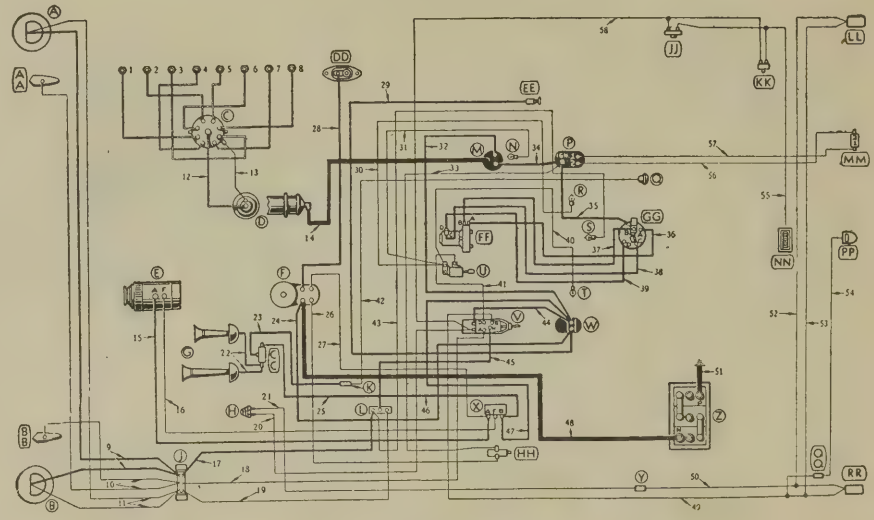
Chevrolet 85, 1940
("Special" & "Master DeLuxe")



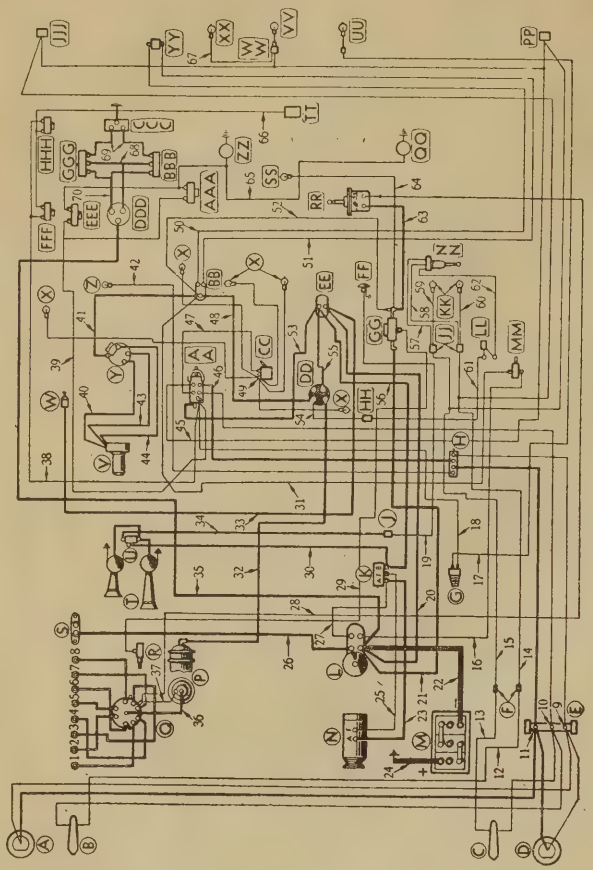
Chevrolet, 1941
(All Models)



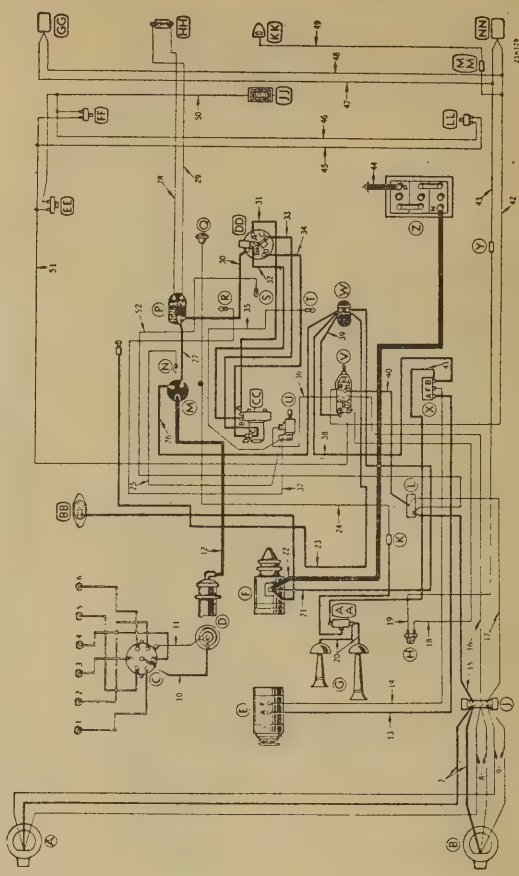
Chrysler 6, 1940
(Model C25 "Windsor" and "Royal")



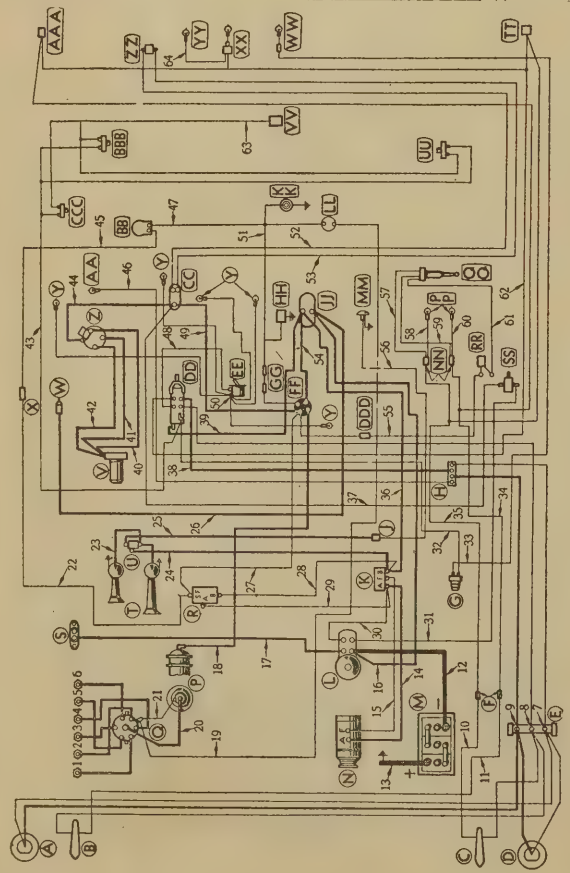
Chrysler 8, 1940
(Model C-26 "Saratoga," "Traveler" and "New Yorker")



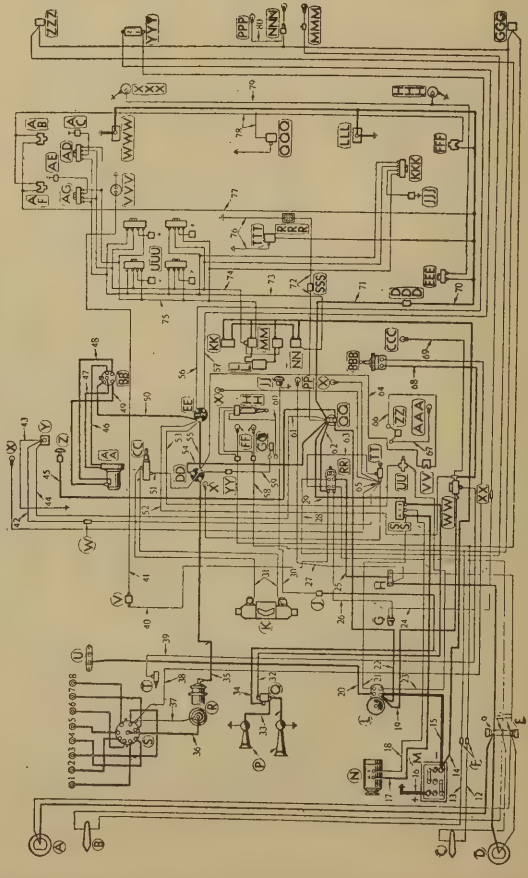
Chrysler 8, 1941
(New Yorker, Saratoga)



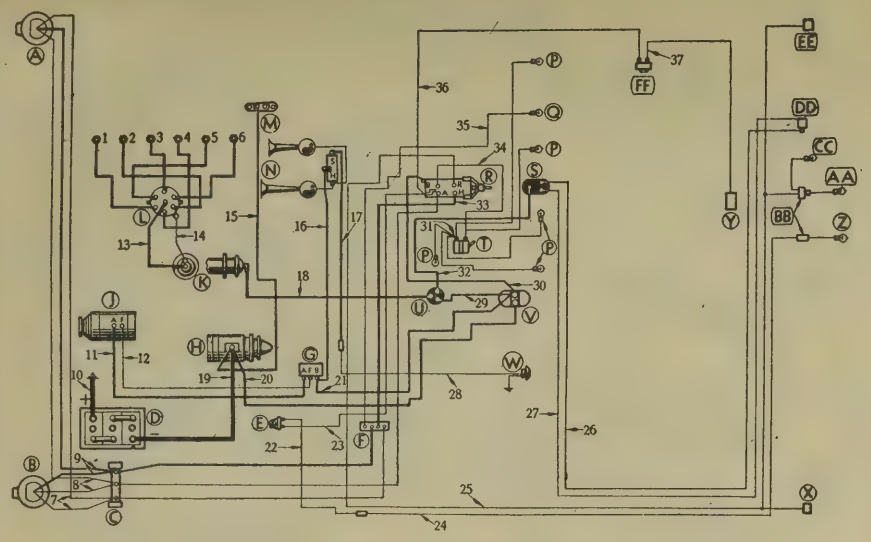
DeSoto, 1940
(S-7 "Custom" & "DeLuxe")



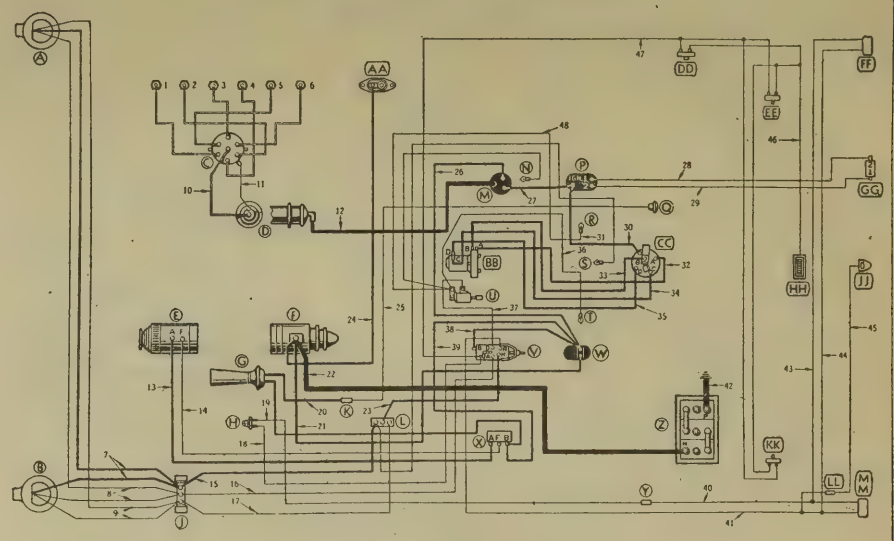
Chrysler Six, 1941
Royal & Windsor)



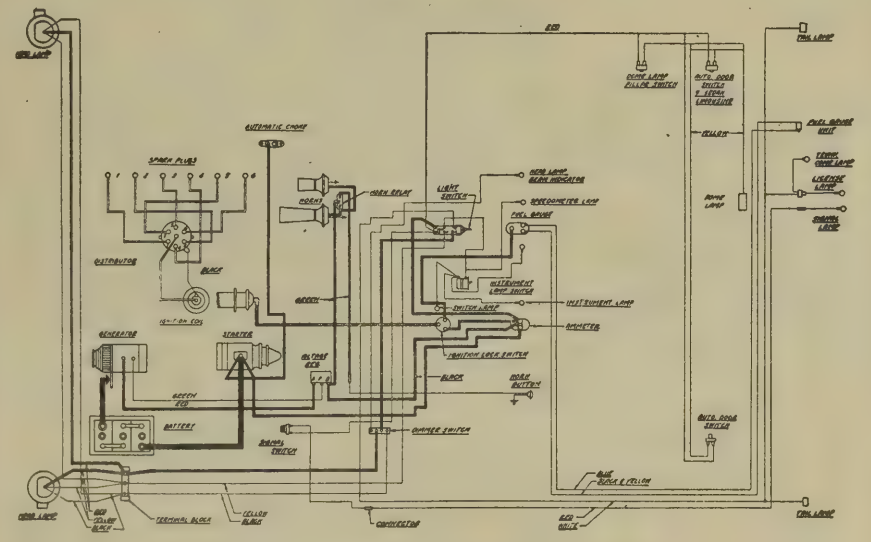
Chrysler 8, 1941
(Crown Imperial 8)



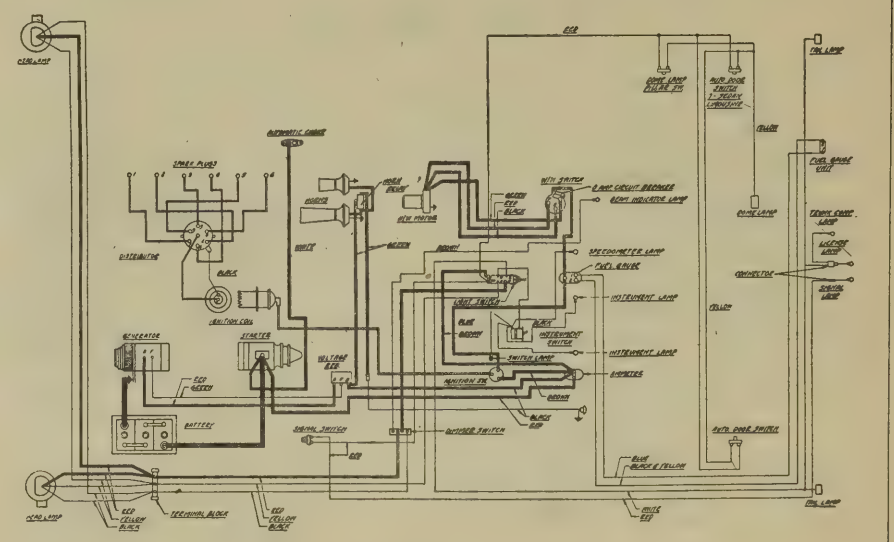
De Soto, 1941
(Model S-8)



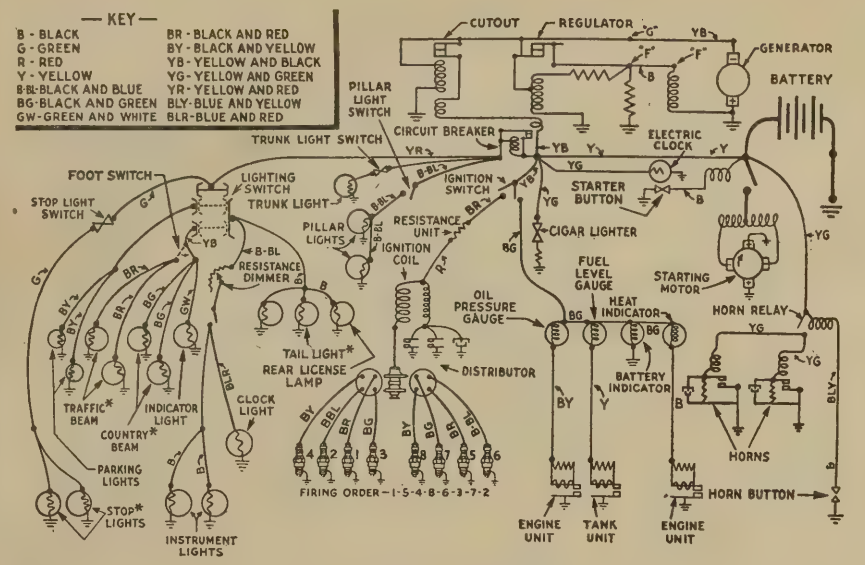
Dodge D-17, 1940



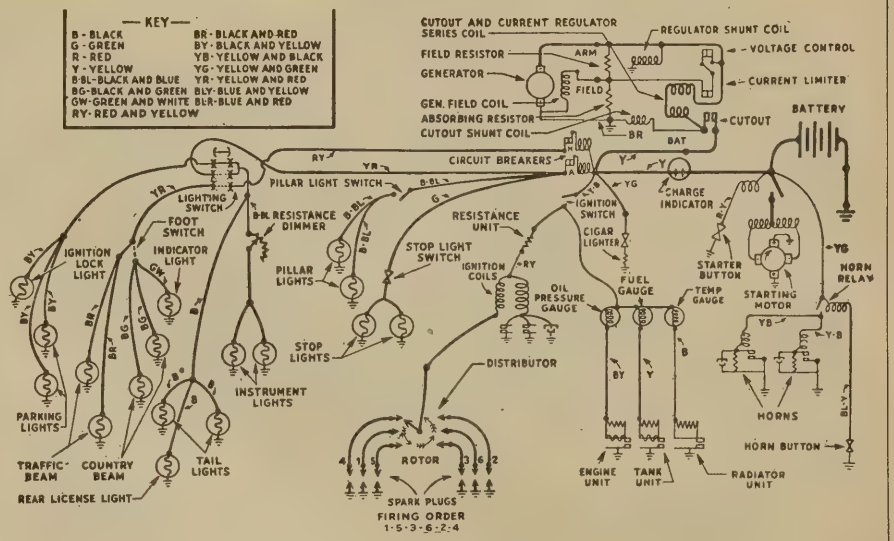
Dodge, 1941
('DeLuxe D-19")



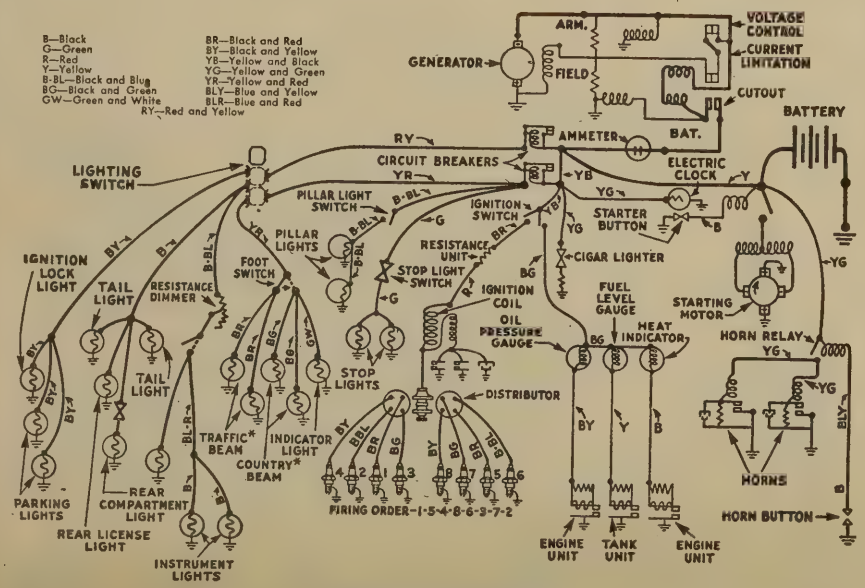
Dodge, 1941
("Custom D-19")



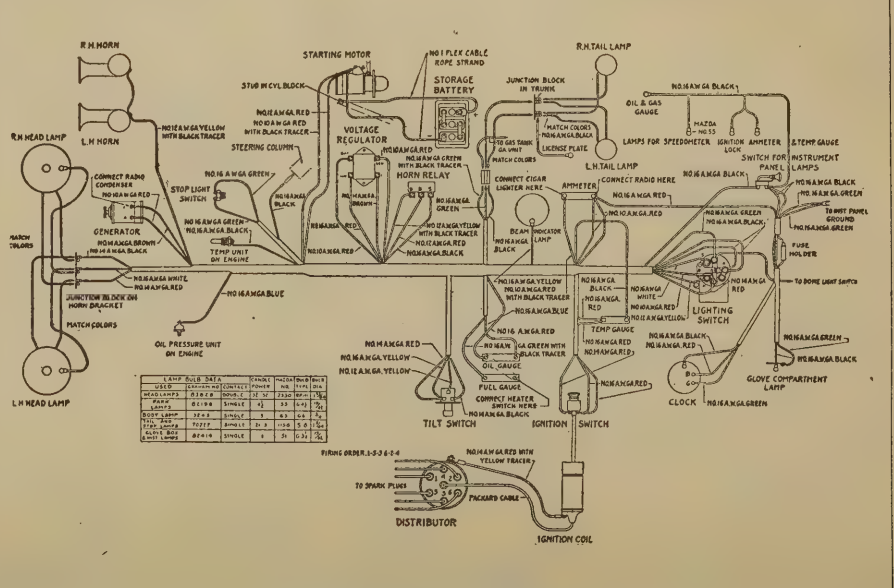
Ford V-8, 1940
(Models 60, 85)



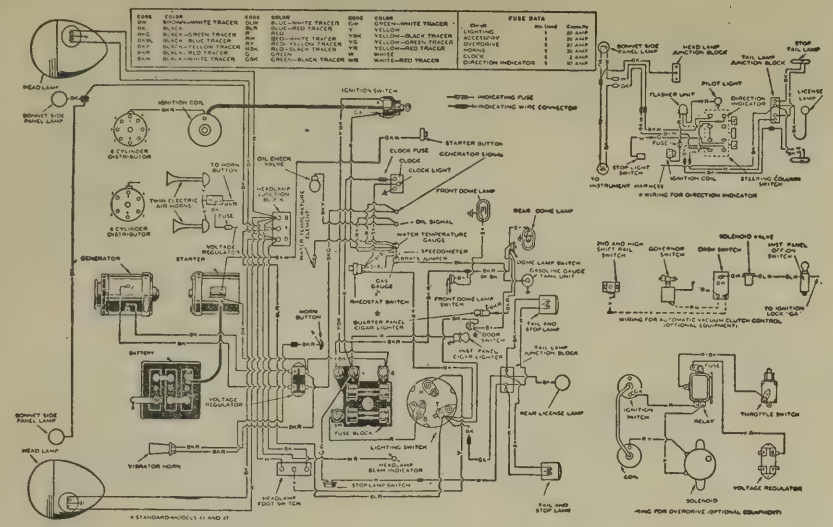
Ford Six, 1941



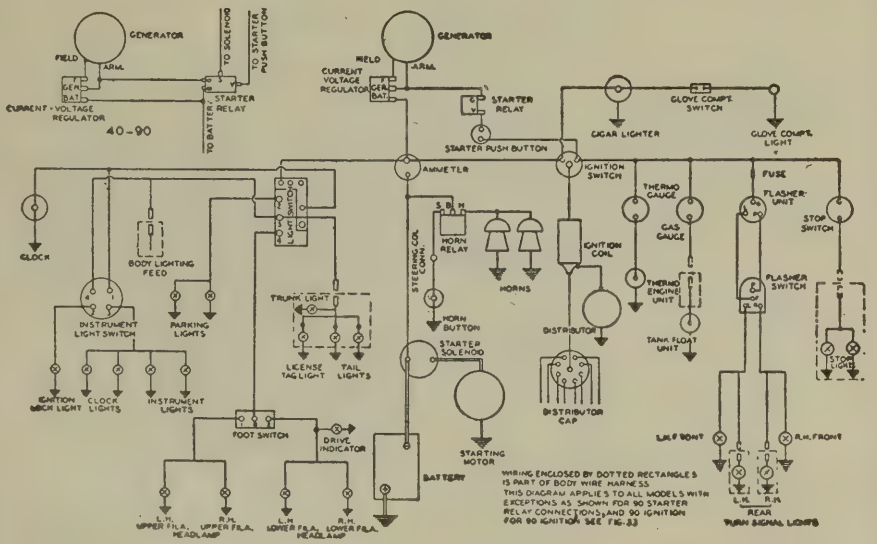
Ford V-8, 1940
(Model 11A)



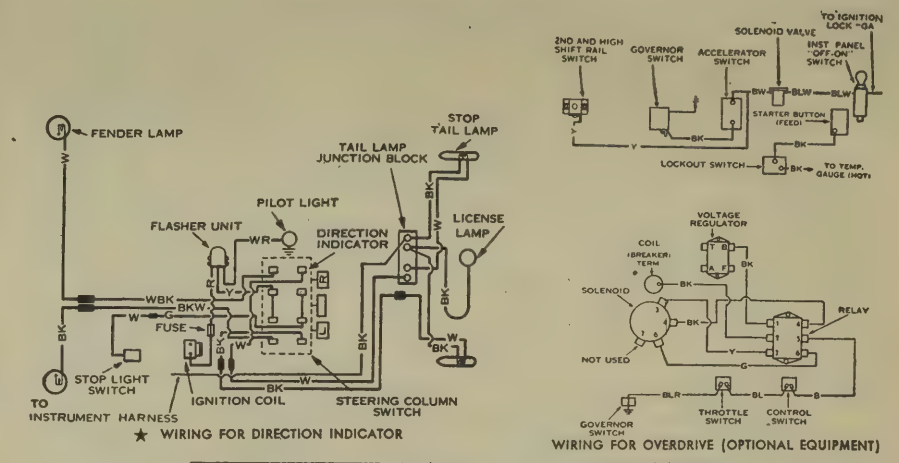
Graham, 1940
(Models 107, Special 108)

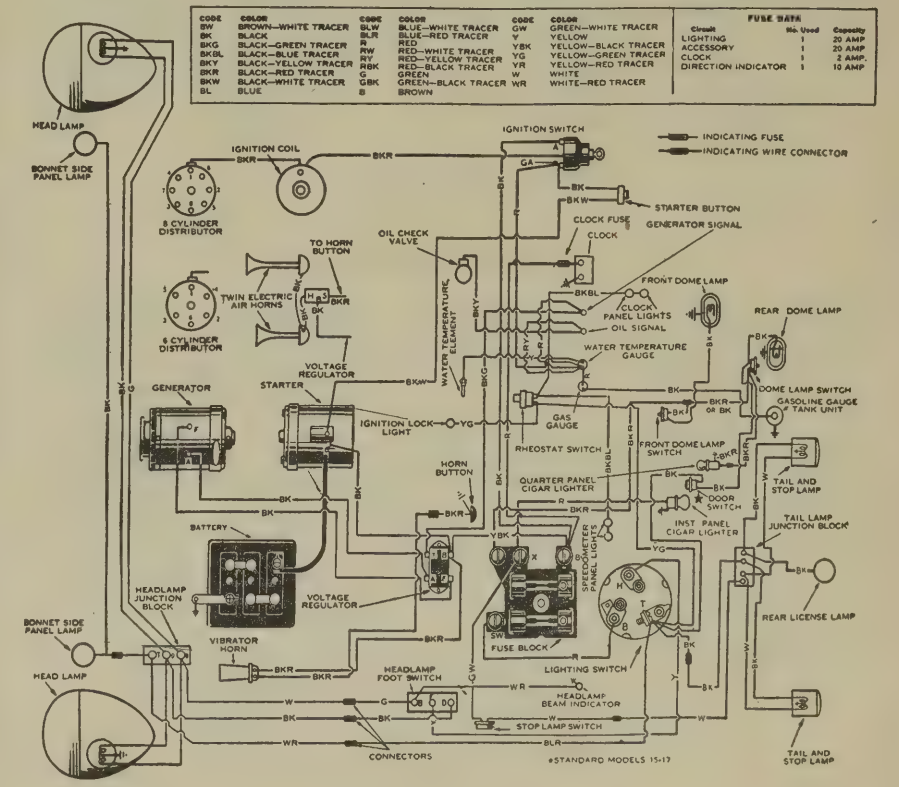


Hudson, 1940
(All Models)

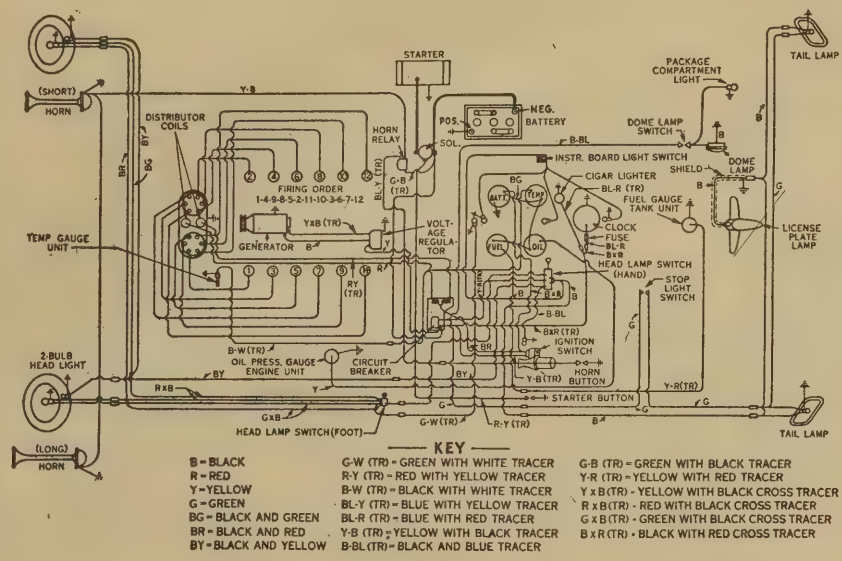


LaSalle, 1940
(Series 40-50 and 40-53)





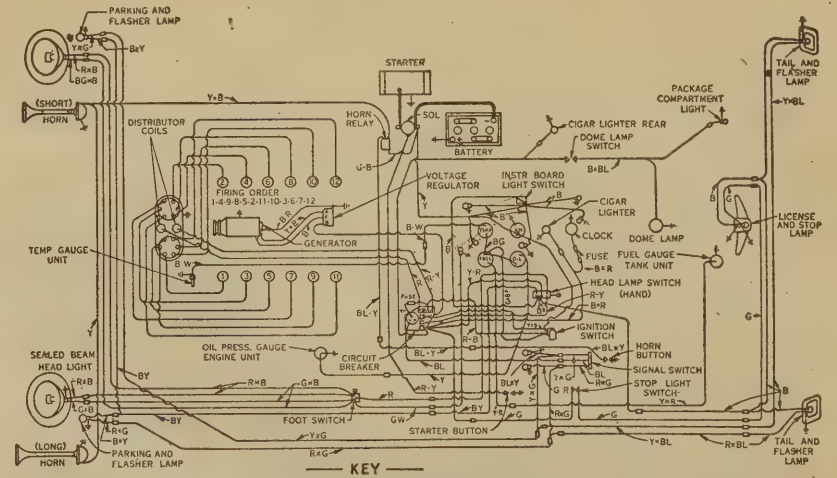
Hudson, 1941
(All Models)



KEY

B = BLACK	G-W (TR) = GREEN WITH WHITE TRACER	G-B (TR) = GREEN WITH BLACK TRACER
R = RED	R-Y (TR) = RED WITH YELLOW TRACER	Y-R (TR) = YELLOW WITH RED TRACER
Y = YELLOW	B-W (TR) = BLACK WITH WHITE TRACER	Y x B (TR) = YELLOW WITH BLACK CROSS TRACER
G = GREEN	BL-Y (TR) = BLUE WITH YELLOW TRACER	R x B (TR) = RED WITH BLACK CROSS TRACER
BG = BLACK AND GREEN	BL-R (TR) = BLUE WITH RED TRACER	G x B (TR) = GREEN WITH BLACK CROSS TRACER
BR = BLACK AND RED	Y-B (TR) = YELLOW WITH BLACK TRACER	B x R (TR) = BLACK WITH RED CROSS TRACER
BY = BLACK AND YELLOW	B-BL (TR) = BLACK AND BLUE TRACER	

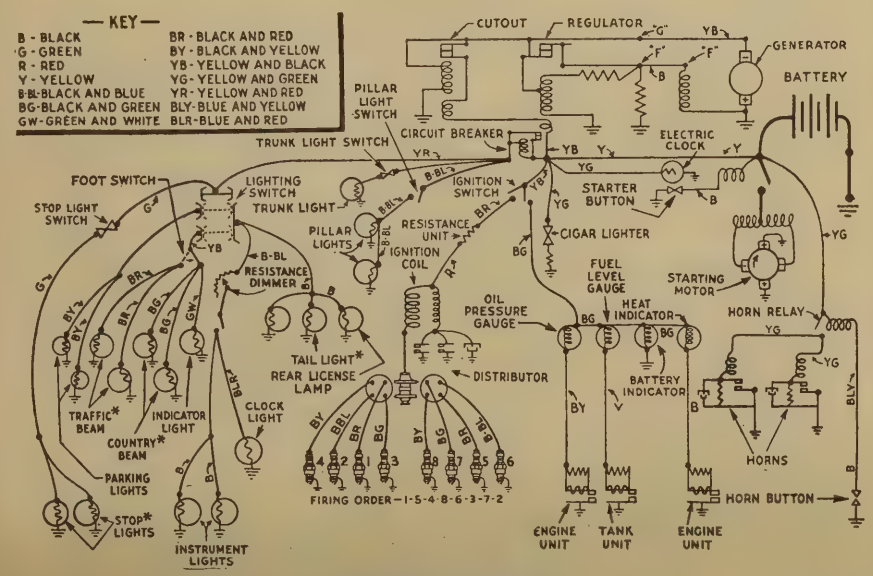
Lincoln-Zephyr, 1940



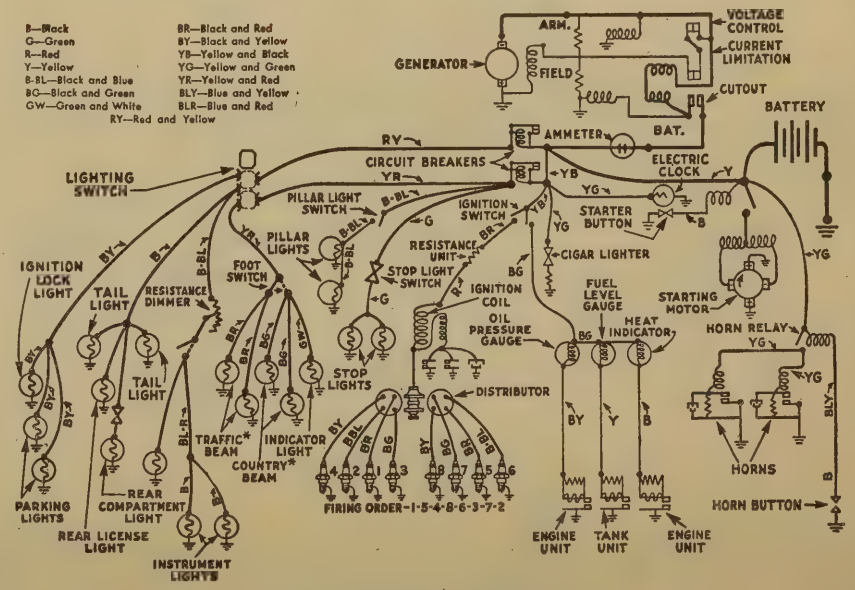
KEY

B = BLACK	G-W = GREEN WITH WHITE TRACER	Y-R = YELLOW WITH RED TRACER
BL = BLUE	B-R = BLACK WITH RED TRACER	B x BL = BLACK WITH BLUE CROSS TRACER
G = GREEN	B-W = BLACK WITH WHITE TRACER	B x R = BLACK WITH RED CROSS TRACER
R = RED	BL-Y = BLUE WITH YELLOW TRACER	B x Y = BLACK WITH YELLOW CROSS TRACER
Y = YELLOW	G-B = GREEN WITH BLACK TRACER	BL x Y = BLUE WITH YELLOW CROSS TRACER
BG = BLACK AND GREEN	R-B = RED WITH BLACK TRACER	G x B = GREEN WITH BLACK CROSS TRACER
BY = BLACK ANDYELLOW	R-Y = RED WITH YELLOW TRACER	G x R = GREEN WITH RED CROSS TRACER
		R x B = RED WITH BLACK CROSS TRACER
		R x BL = RED WITH BLUE CROSS TRACER
		R x G = RED WITH GREEN CROSS TRACER
		Y x B = YELLOW WITH BLACK CROSS TRACER
		Y x BL = YELLOW WITH BLUE CROSS TRACER
		Y x G = YELLOW WITH GREEN CROSS TRACER
		Y x R = YELLOW WITH RED CROSS TRACER

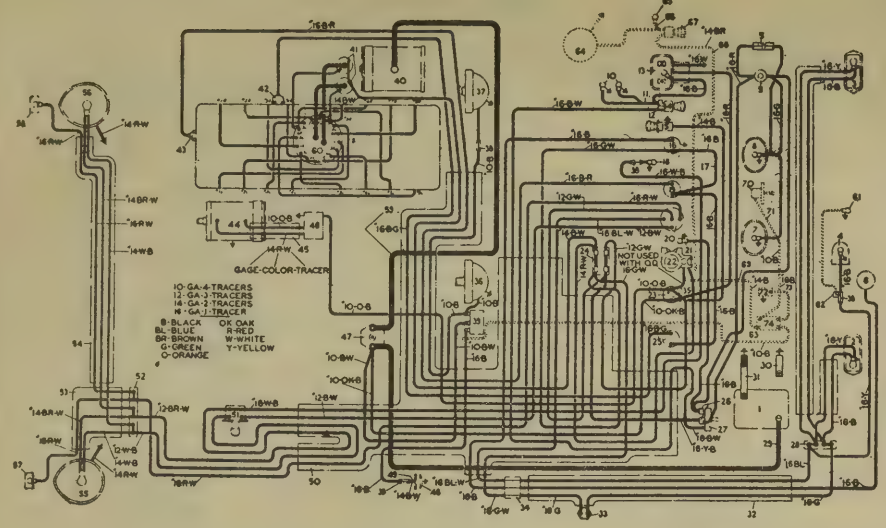
Lincoln-Zephyr, 1941



Mercury, 1940

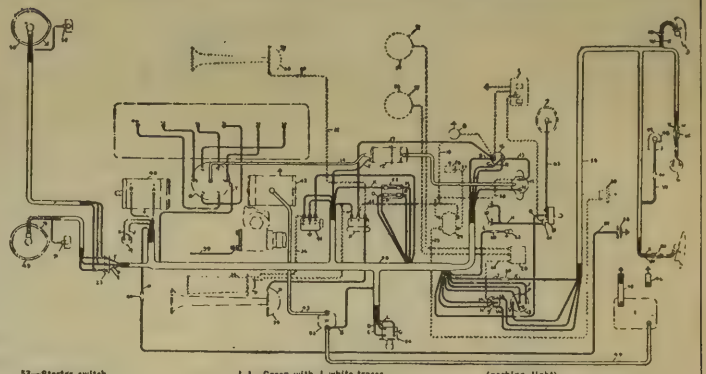


Mercury, 1941



Nash 8, 1940
(Series 4080)

1—Battery
2—Stop and tail light—left
3—Stop and tail light—right
4—Stop light switch
5—Clock (spec. equip.)
6—Gasoline gauge—tank unit
7—Dome light
8—Cigar lighter (spec. equip.)
9—Gasoline gauge—dash unit
10-11—Instrument panel lights and wires
12—Ignition coil and switch
13—Ammeter to ign. switch wire (not used with O. D.)
14—Ign. coil to dist. luter wire
15—Distributer
16—Ammeter
17—Ammeter to horn relay—4140-2-3-8
18—Ammeter to O. D relay (with O. D. 4145-47)
19—Lighting switch
20—Defroster switch (spec. equip.)
21—Instrument light switch
22—Beam indicator light
23—Head light junction block
24—Overdrive relay (spec. equip. with O. D.)
25—O. D. relay to horn relay (spec. equip. with O. D.)
26—Overdrive switch (spec. equip. with O. D.)
27—O. D. relay to switch (spec. equip. with O. D.)
28—O. D. relay to ign. switch (spec. equip. with O. D.)
29—O. D. relay to O. D. solenoid (spec. equip. with O. D.)
30—Overdrive solenoid (spec. equip. with O. D.)
31—Horn relay on 4140-2-3-8 only
32—Horn relay to connection—St. 4140 sp. equip. 2-3-8
33—Horn—St. 4140 spec. equip. 4142-3-8
34—Horn—St. 4140-2-3-8
35—Horn—4145-47 models only
36—Horn to volt. reg. wire—4145-47 models only
37—Steering gear horn wire
38—Horn button
39—S ering gear to frame ground wire
40—Generator
41—Voltage regulator
42—Starting mo or
43—Starting motor to starter switch cable
44—Starter switch to battery cable
45—Battery to body ground cable
46—Body to power unit ground cable
47—License plate lamp—4140-2-3-8
48—License plate lamp—4145-47 only
49—Head lamp—left
50—Head lamp—right
51—Parking light—left
52—Parking light—right

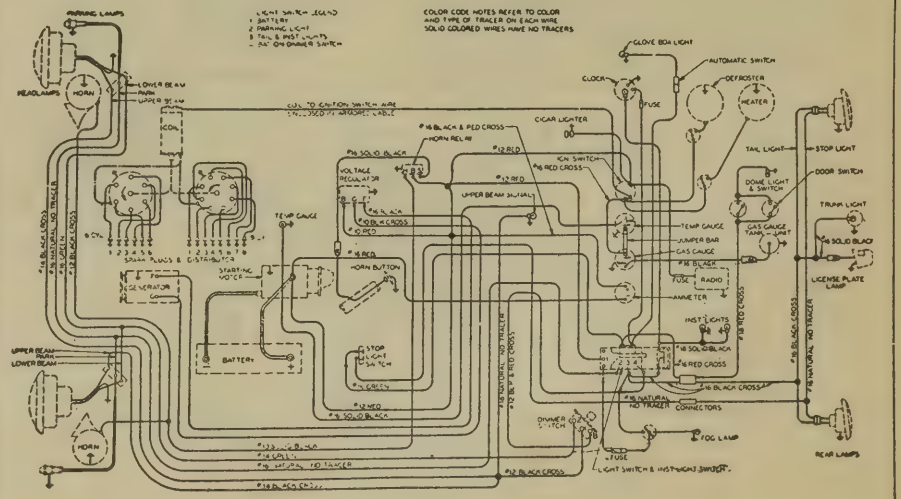


53—Starter switch
54—Foot dimmer switch
55—Fuse block
56—Defroster motor—l ft (spec. equip.)
57—Defroster motor—right (spec. equip.)
58—Main wiring harness
59—Tail and stop light harness (in body)
60—2 wire connector
61—Junction terminals (when clock is used)
62—Gas gauge dash unit to defroster switch wire
63—Instr. light sw. to dome light wire—red (in body)
A-A—Orange with 4 black tracers
B-B—Green with 2 white tracers
C-C—Red with 4 white tracers
D-D—Brown with 3 black tracers
E-E—White with 3 black tracers
F-F—Red with 1 white tracer
G-G—Black with 3 white tracers
H-H—Black with 2 white tracers
J-J—Green with 1 white tracer
K-K—Green with 1 white tracer
L-L—White
M-M—Black with 1 white tracer
N-N—Black with 1 white tracer
O-O—Yellow with 1 black tracer
P-P—Green with 3 white tracers
R-R—Red with 3 white tracers
S-S—Oak with 4 black tracers
T-T—Red with 2 white tracers
U-U—Yellow and black
V-V—Black
W-W—Blue
X-X—Green with 1 black tracer
10—Generator to voltage regulator
14—Generator field to voltage regulator
12—Dimmer switch to junction block (headlamp—low beam)
15—Light switch to junction block (parking light)
16—Fuse block to stop light switch
18—Dimmer switch to connector (pilot light)
14—Fuse block to ignition coil
16—Fuel gauge to fuse block
16—Rheostat to fuse block
12—Fuse block to light switch
12—Ammeter to fuse block
18—Ammeter to starter switch
14—Fuse block to ignition switch
19—Horn relay to starter switch
12—Horn relay to right horn
18—Fuel gauge—dash unit to gas tank unit No. 1
18—Fuel gauge—dash unit to gas tank unit No. 2
18—Light switch to tail and license plate lamps
16—Stop light to connector
(parking light)
12—Light switch to dimmer switch
16—Horn or horn relay to connector
18—Stop light switch to connector
18—Stop l ght switch to fu e block
18—Dimmer switch to connector (pilot light)
16—Fuse block to gas gauge (dash unit)
18—Gas gauge to ignition switch
16—Fuse block to panel light switch
12—Fuse block to light switch
12—Ammeter to fuse block
18—Ammeter to starter switch
16—Coil to distributer
18—Gas gauge—dash unit to gas tank unit No. 1
18—Gas gauge—dash unit to gas tank unit No. 2
18—Light switch to tail and license plate lamps
16—Stop lights to connector

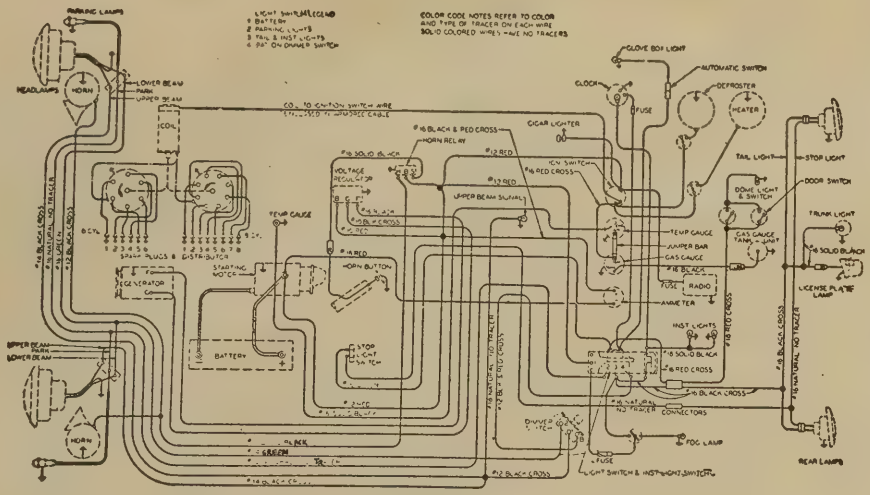
Nash 6, 1941
(Models 4140, 600-6)

1—Battery
2—Stop and tail light—left
3—Stop and tail light—right
4—License plate lamp
5—Clock (spec. equip.)
6—Gasoline gauge—tank unit
7—Dome light
8—Cigar lighter (spec. equip.)
9—Gasoline gauge—dash unit
10-11—Instrument panel lights and wires
12—Ignition coils
13—Distributor
14—Ammeter
15—Ammeter to ign. sw. wire (not used with O. D.)
16—Instr. light rheostat
17—Rheostat to post sw. wire—Green (in body)
18—Rheostat to post sw. wire—Red (in body)
19—Post sw. to dome light wire—Green (in body)
20—Post switch
21—Ignition switch light
22—Ignition switch lock
23—Ign. sw. to O. D. Relay wire (spec. equip.)
24—Overdrive relay (spec. equip. with O. D.)
25—O. D. relay to horn relay wire (spec. equip. with O. D.)
26—O. D. switch (spec. equip. with O. D.)
27—O. D. switch to O. D. relay wire (spec. equip. with O. D.)
28—O. D. relay to solenoid (spec. equip. with O. D.)
29—O. D. solenoid (spec. equip. with O. D.)
30—Defroster switch (spec. equip.)
31—Defroster sw. to gas. gauge dash unit wire
32—Horn relay
33—Fuse block
34—Voltage regulator
35—Light switch
36—Starter switch
37—Starter switch to starter motor cable
38—Starter switch to battery cable
39—Battery to body ground cable
40—Body to unit power plant ground cable
41—Starting motor
42—Generator
43—Stop light switch
44—Head light junction block
45—Foot dimmer switch
46—Defroster motor—left (spec. equip.)
47—Defroster motor—right (spec. equip.)
48—Horn—left
49—Horn—right
50—Head lamp—left
51—Head lamp—right
52—Parking light—left
53—Parking light—right
54—Main wiring harness
55—Tail and stop light harness (in body)
56—2 Wire connector
57—Horn button
58—Steering gear horn wire
A-A—Orange with 4 black tracers
B-B—Green with 2 white tracers
C-C—Red with 4 white tracers
D-D—Brown with 3 black tracers
E-E—White with 3 black tracer
F-F—Red with 1 white tracer
G-G—Black with 3 white tracers
H-H—Black
J-J—Green with 1 white tracer
K-K—Green with 1 white tracer
L-L—White
M-M—Black with 2 white tracers
N-N—Black with 1 white tracer
O-O—Yellow with 1 black tracer
P-P—Green with 3 white tracers
R-R—Red with 3 white tracers
S-S—Oak with 4 black tracers
T-T—Red with 2 white tracers
U-U—Black with 4 white tracers
V-V—Black with 3 white tracers
W-W—Yellow and black
X-X—Black
Y-Y—Blue
Z-Z—Green with 1 white tracer
10—Generator to voltage regulator
14—Generator field to voltage regulator
16—Ammeter to voltage regulator
12—Dimmer switch to junction block (headlamp—high beam)
12—Dimmer switch to junction block (headlamp—low beam)
16—Light switch to junction block (parking light)
12—Light switch to dimmer switch
16—Horn relay to connector
18—Stop light switch to connector
16—Fuse block to stop light switch
18—Dimmer switch to connector (pilot light)
14—Fuse block to ignition coil
16—Fuel gauge to fuse block
16—Rheostat to fuse block
12—Fuse block to light switch
12—Ammeter to fuse block
18—Ammeter to starter switch
14—Fuse block to ignition switch
19—Horn relay to starter switch
12—Horn relay to right horn
18—Fuel gauge—dash unit to gas tank unit No. 1
18—Fuel gauge—dash unit to gas tank unit No. 2
18—Light switch to tail and license plate lamps
16—Stop light to connector

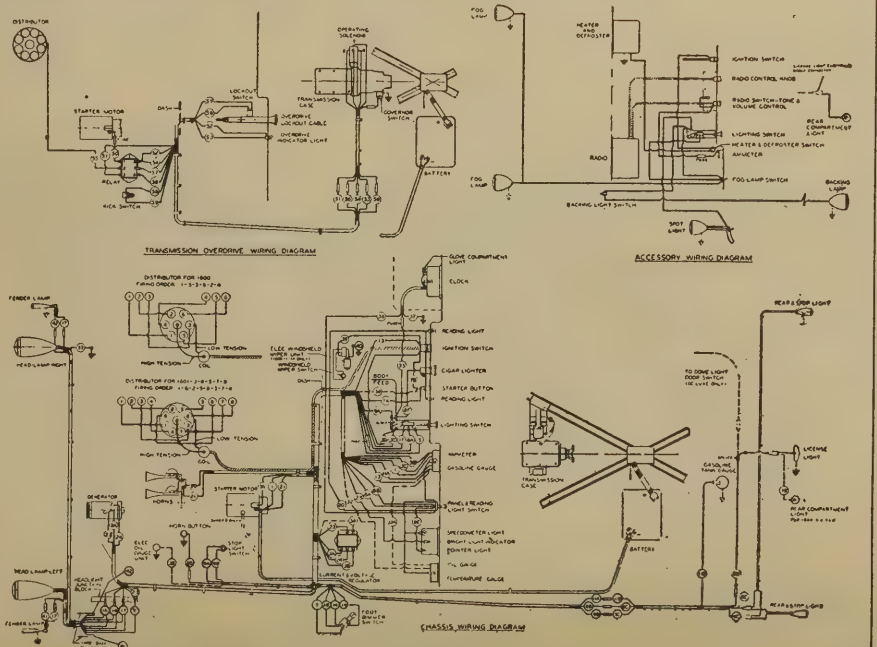
Nash 6, 8, 1941
(Models, 4160-6, 4180-8)



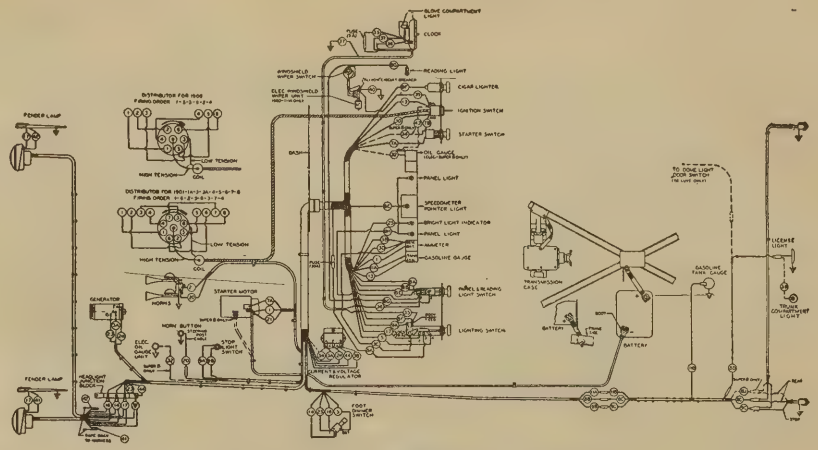
Oldsmobile 6, 1941

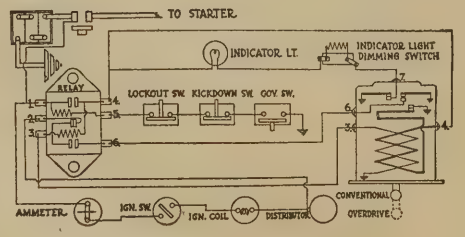


Oldsmobile 8, 1941



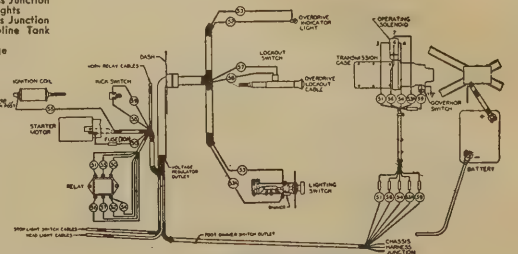
Packard, 1940
(All Models)





CHASSIS WIRING

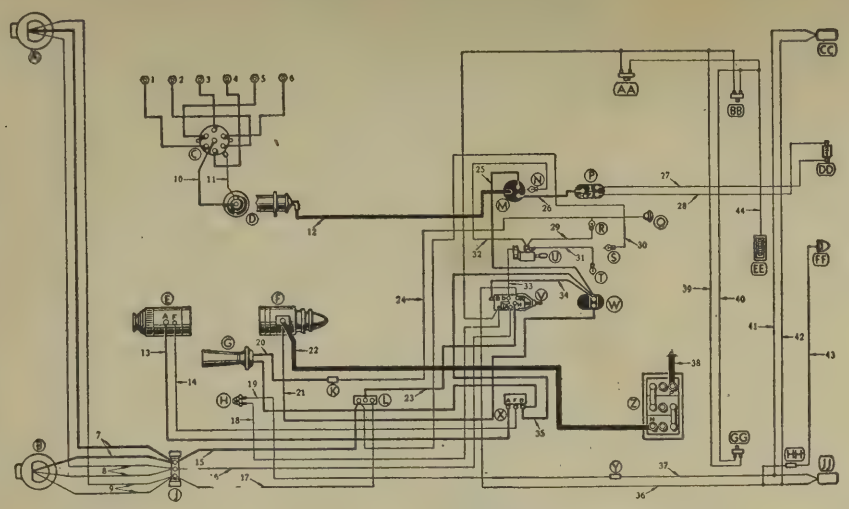
No.	Ga.	Color	Location
1	10	Red	Starter Motor Switch to Ammeter
3A	10	Red	Current Regulator to Generator
3B	10	Black	Current Regulator to Ammeter
3C	12	Black	Lighting Switch to Ammeter
3D	12	Black	Ammeter to Ignition Switch
5	14	Black	Lighting Switch to Foot Dimmer Switch
7A	16	Black	Starter Switch to Starter Motor Switch
7B	16	Black	Starter Switch to Ignition Switch (Not Used on Super 8)
8A	16	Black	Lighting Switch to Panel Light Switch
8B	16	Black	Panel Light Switch to Rear Harness Junction
8C	16	Black	Rear Harness Junction to Rear Lights
8D	16	See Drawing	Rear Harness to License Light
8E	16	Black	Panel Light Switch to Speedometer Pointer Light
8F	14	Yellow	Cigar Lighter to Lighting Switch
8G	16	Black	Panel Light Switch to Reading Lights
8H	16	Black	Panel Light Switch to Panel Lights
8J	16	Black	Splice at 8C to Rear Lights (Upper)
9A	16	Green	Fuse at Lighting Switch to Stop Light Switch
9B	16	Green	Stop Light Switch to Rear Harness Junction
9C	16	Green	Rear Harness Junction to Stop Lights
11A	18	Tan with	Gasoline Gauge to Rear Harness Junction
11B	18	Black and Red	Rear Harness Junction to Gasoline Tank Gauge
13	16	Black	Ignition Switch to Gasoline Gauge
14	14	Red	Foot Dimmer Switch to Junction Block and Headlamps (City)
16	14	Green	Foot Dimmer Switch to Junction Block and Headlamps (Drive)
17	16	Black with Red	Lighting Sw. to Junction Block to Lamp Junction and Fender Lamps
20	16	Brown	Steering Post Horn Button to Horn Relay
21	12	Black	Starter Motor Switch to Horn Relay
23	14	Black	Generator to Headlamp Junction Block
24	18	Brown	Current Regulator to Generator
25	18	White	Foot Dimmer Switch to Speedometer Bright Light Indicator
32	16	Yellow with Black	El. Oil Gauge (Panel) to El. Oil Gauge Unit (Motor) (Super 8 Only)
34	16	Black	Current Regulator to Starter Switch (Super 8 Only)
35	18	Red	Lighting Switch to Fuse at Clock
36	18	Black	Clock to Panel Light Switch
37	18	White	Clock to Glove Compartment Door Hinge Screw
38	16	Black	Rear Compartment Light to License Light Electric Cable Connector
39	16	Red	Electric Windshield Wiper Unit to Ignition Switch
40	16	Green	Electric Windshield Wiper Unit to Ignition Switch Mounting Screw
41	16	Yellow	Fender Lamp Left to Lamp Junction Block
42	16	Yellow	Fender Lamp Right to Lamp Junction Block
43	16	Black	Ignition Switch to Electric Oil Gauge (Super 8 Only)
44	14	Black	Current Regulator to Headlight Junction Block



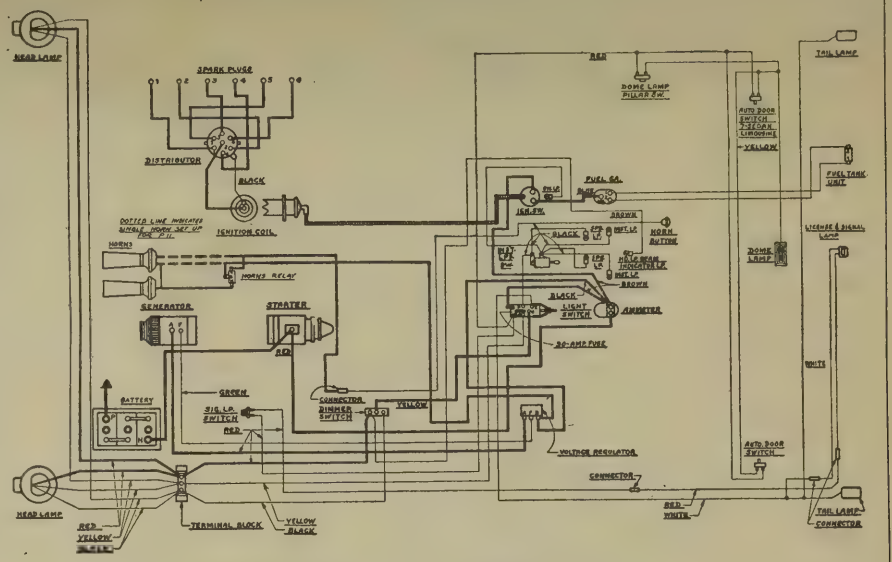
ECONO-DRIVE WIRING

No.	Ga.	Color	Location
50	12	Black	Starter Motor Switch to Relay Post No. 1
51	14	Yellow	Relay Post No. 3 to Solenoid Post No. 3
52	18	Brown	Relay Post No. 4 to Overdrive Indicator Light
53	18	Brown	Lighting Switch to Overdrive Indicator Light
54	12	Black	Relay Post No. 4 to Solenoid Post No. 4
55	16	Green	Relay Post No. 2 to Ignition Coil—Low Tension Post
56	16	Green	Relay Post No. 6 to Solenoid Post No. 6
57	16	Black with Red	Relay Post No. 5 to Overdrive Lock-out Switch
58	16	Black with Red	Kick Switch to Overdrive Lock-out Switch
59	16	Black with Red	Kick Switch to Governor Switch
53A	18	Brown	Lighting Switch to Solenoid Post No. 7

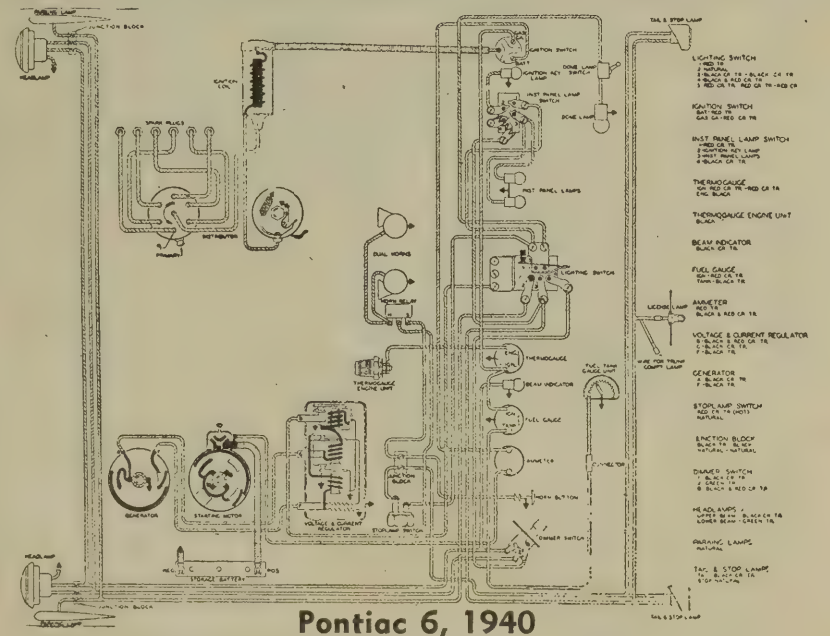
Packard, 1941
(All Models)



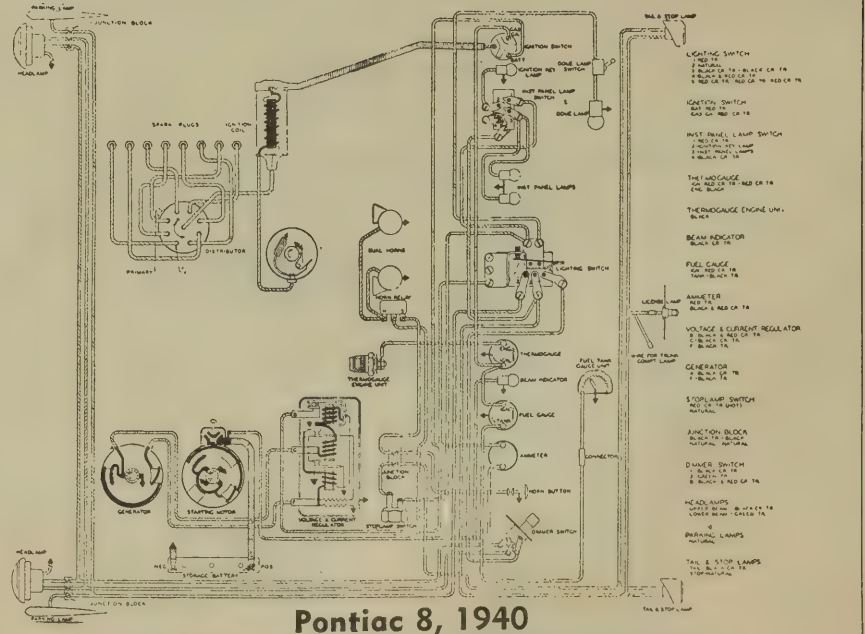
Plymouth P-9, 1940
("Roadking" and "DeLuxe")



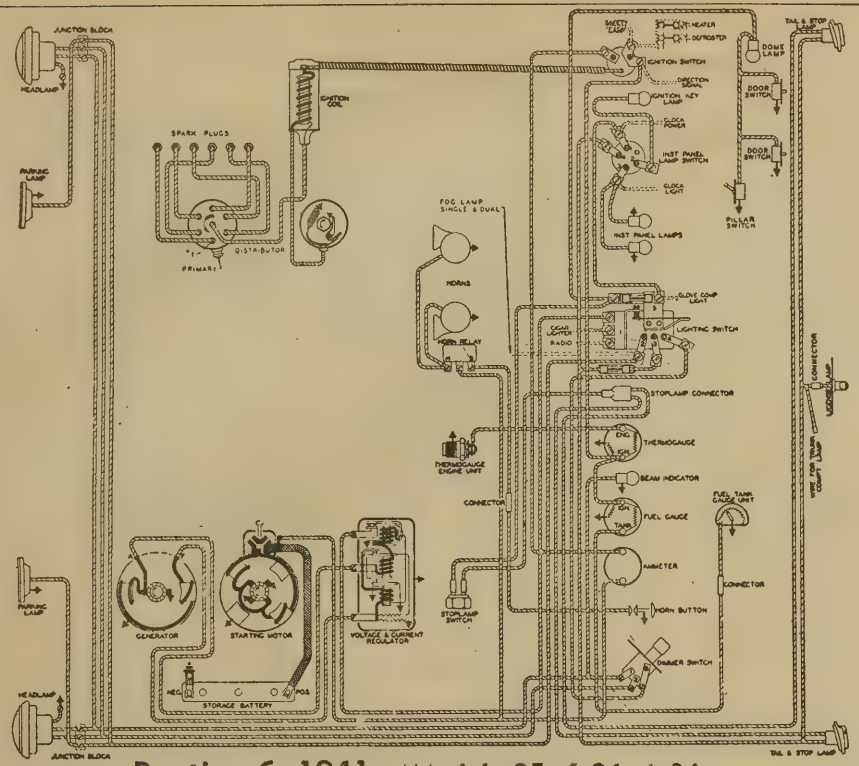
Plymouth, 1941
(Models P-11, P-12)



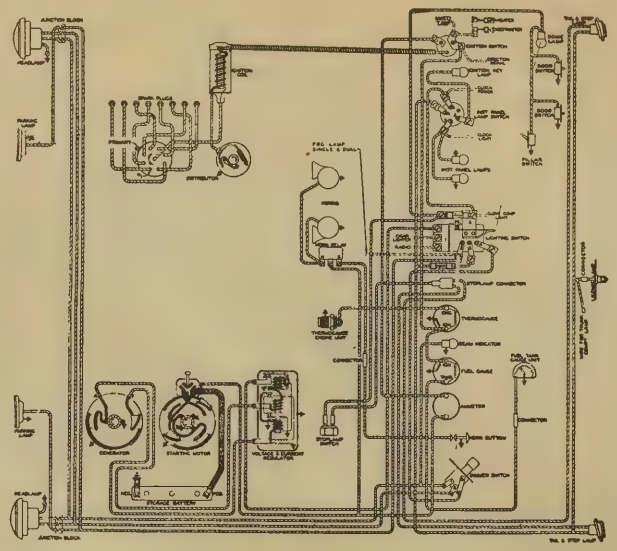
Pontiac 6, 1940
("Special Six" 40-25 and "DeLuxe Six" 40-26)



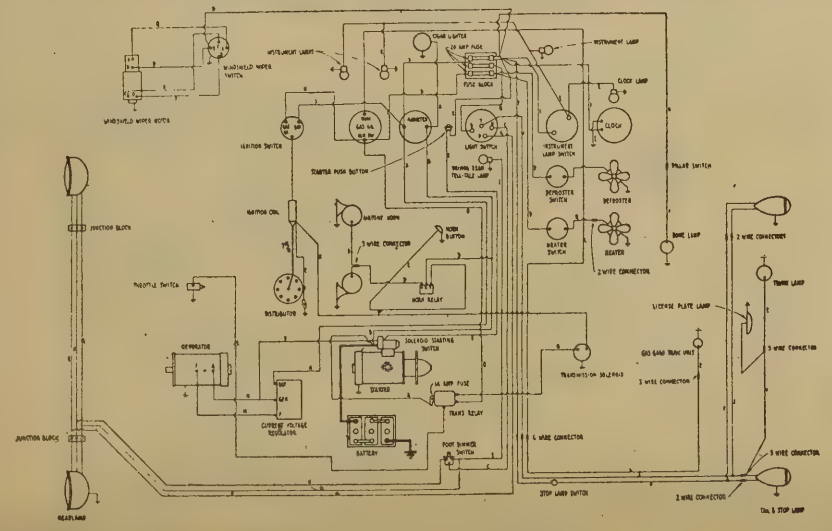
Pontiac 8, 1940
("DeLuxe" 40-28 and "Torpedo" 40-29)



Pontiac 6, 1941 (Models 25, 6-26, 6-24)

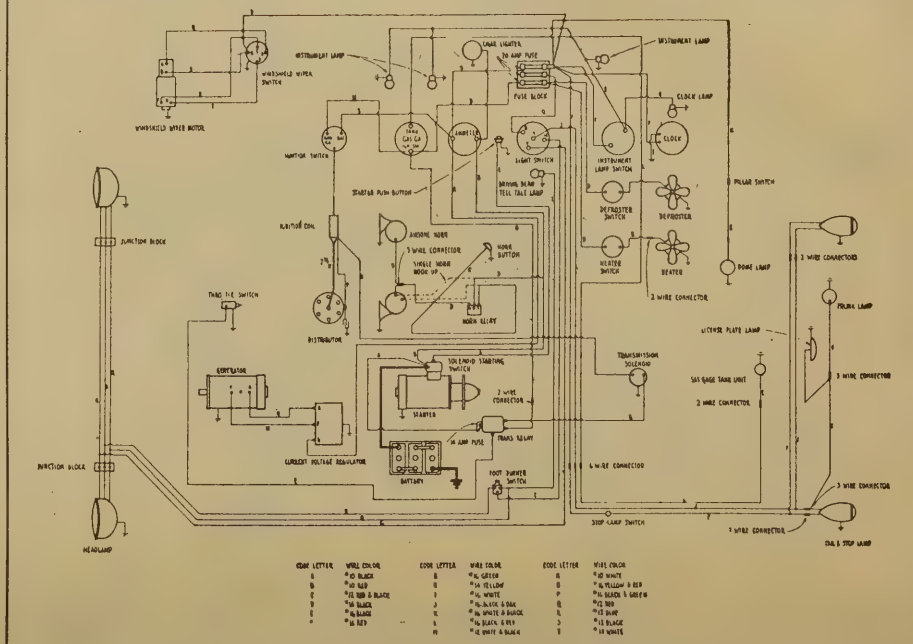


Pontiac 8, 1941
(Models 8-27, 8-28, 8-29)



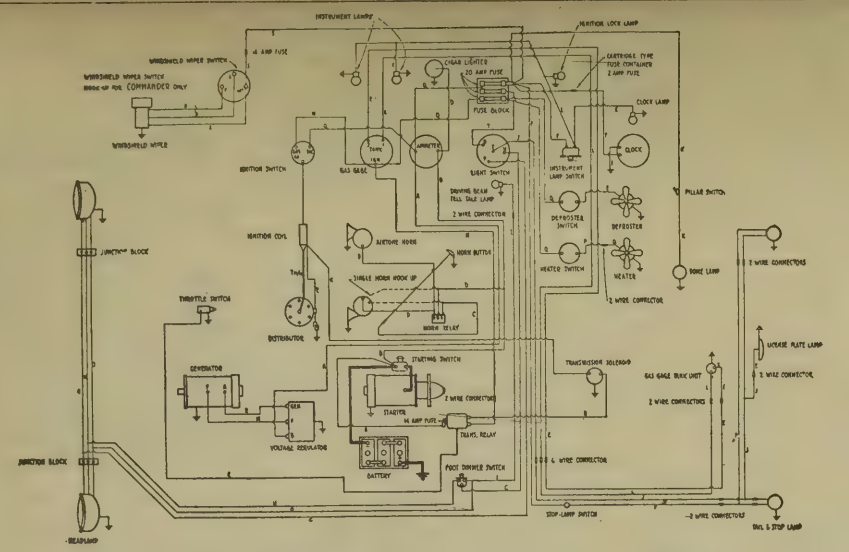
CODE LETTER	WIRE COLOR	CODE LETTER	WIRE COLOR	CODE LETTER	WIRE COLOR
A	#10 BLACK	G	#14 GREEN	N	#18 WHITE
B	#10 RED	H	#14 YELLOW	O	#14 YELLOW & RED
C	#12 RED & BLACK	I	#14 WHITE	P	#14 BLACK & GREEN
D	#14 BLACK	J	#14 BLACK & RED	Q	#12 RED
E	#14 BLACK	K	#14 WHITE & BLACK	R	#12 BLUE
F	#14 RED	L	#14 BLACK & RED	S	#12 BLACK
		M	#12 WHITE & BLACK	T	#14 WHITE

Studebaker "Commander 6", 1940 (Model 10A)

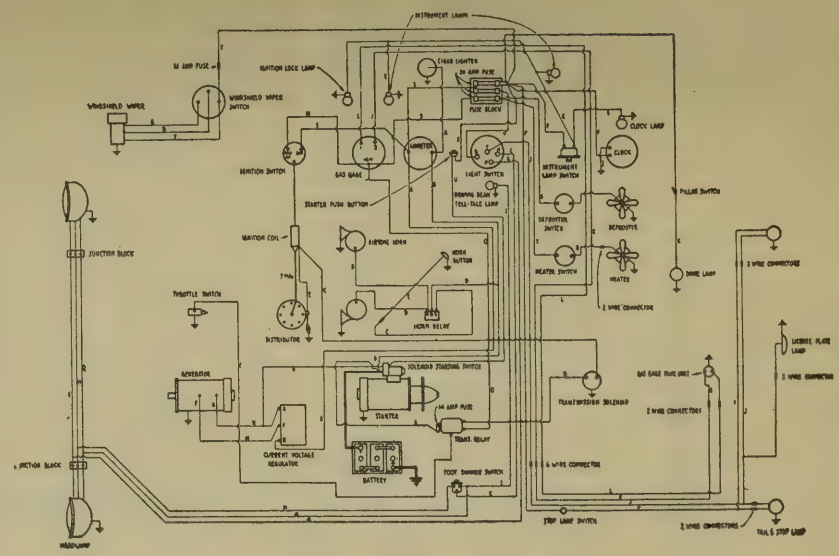


CODE LETTER	WIRE COLOR	CODE LETTER	WIRE COLOR	CODE LETTER	WIRE COLOR
A	#10 BLACK	G	#14 GREEN	N	#18 WHITE
B	#10 RED	H	#14 YELLOW	O	#14 YELLOW & RED
C	#12 RED & BLACK	I	#14 WHITE	P	#14 BLACK & GREEN
D	#14 BLACK	J	#14 BLACK & RED	Q	#12 RED
E	#14 BLACK	K	#14 WHITE & BLACK	R	#12 BLUE
F	#14 RED	L	#14 BLACK & RED	S	#12 BLACK
		M	#12 WHITE & BLACK	T	#14 WHITE

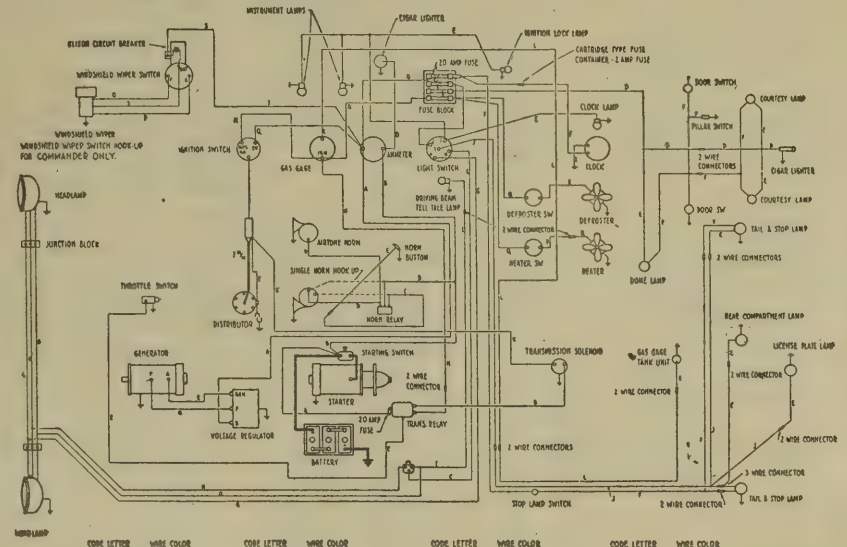
Studebaker "President", 1940
(Model 6C)



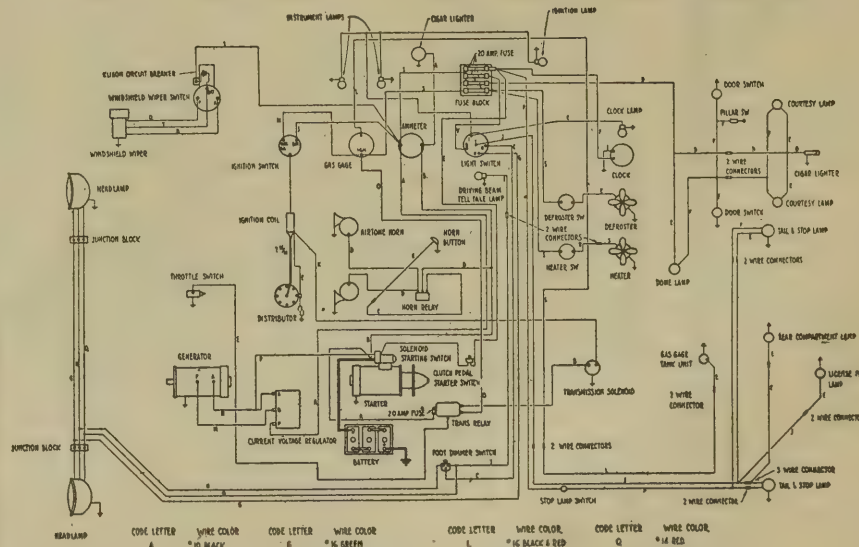
Studebaker "Commander", "Champion", 1941
(Models 11A, 3G)



Studebaker "President", 1941
(Model 7C)


CODE LETTER WIRE COLOR
A — #10 BLACK
B — #10 RED
C — #12 RED & BLACK
D — #14 BLACK
E — #16 BLACK
F — #16 RED
G — #16 GREEN
H — #14 YELLOW
I — #16 WHITE
J — #16 BLACK & OAK
K — #16 WHITE & BLACK
L — #16 BLACK & RED
M — #12 WHITE & BLACK
N — #16 YELLOW & RED
O — #14 RED
P — #12 BLUE
Q — #12 BLACK
R — #10 WHITE
S — #16 GREEN
T — #12 RED

Studebaker "Commander", Champion, 1942
(Models 12A, 4G)



Studebaker "President", 1942
(Model 8C)

VIBRATOR BUFFER-CONDENSER REPLACEMENT CHART

Action and Purpose of the Buffer Condenser

The buffer condenser, connected across the secondary of the transformer, is an important and essential component of most vibrator circuits. Its purpose is primarily to remove the inductive kick-back (reverse-surge) voltage peaks which are set up in the secondary circuit of the transformer by the rapid collapse of the magnetic flux each time a vibrator point opens the circuit. These voltage peaks are objectionable because they endanger the secondary winding insulation on the transformer, and, in the case of a non-synchronous vibrator, seriously damage the rectifier tube.

The buffer condenser removes the voltage peaks by storing an electrical charge while the vibrator points are in contact. When the points open, this stored energy discharges *back* into the transformer secondary in the *opposite* direction and thereby *bucks* the inductive surge voltage that ordinarily occurs there.

What Happens if Replacement Buffer of Incorrect Capacity is Used

It is evident that if the capacity of a condenser is too small, it will not store sufficient charge to completely neutralize the surge peaks. If the capacity is too large it will neutralize the peaks but it will also increase the current drain of the set, cause excessive vibrator point wear and introduce hum in the receiver.

Explanation of the Chart

As it is important that the buffer be of the proper capacity, it is essential that replacement buffers of the correct values be used whenever it becomes necessary to replace a faulty unit. This chart has been compiled to supply the correct buffer condenser capacity values used by the set manufacturers for all auto-radio receivers, 6 and 32-volt farm receivers, police receivers, 12-volt aviation receivers, and power pack units which employ vibrators, so that the service man may quickly ascertain the correct replacement buffer to use for any such receiver. The chart has been compiled from data furnished through the courtesy of the Engineering Departments of *The Radiart Corporation* and numerous *radio receiver manufacturers,* and is included here by their special permission.

Where "split buffers" are employed [this term refers to the two buffer condensers (instead of a single one) usually used with synchronous vibrators to by-pass the high-voltage r-f "hash" interference to ground] the fact is noted in the chart by the numeral (2) in parenthesis after the capacity value. This indicates that two similar condensers of the capacity value indicated must be used.

In some receivers the buffer is incorporated within the vibrator unit and therefore is automatically being replaced when a new vibrator is installed. In all such cases, the fact is noted in the chart.

Replacement buffer condensers should preferably be of the oil-impregnated type and rated at 1600 V. d-c working voltage—or higher.

Several different buffer circuit arrangements are employed in practice. In some cases one or more buffer condensers are used alone. In others, resistors are used, either alone or in combination with buffer condensers. In still others, protective spark gaps are used (either alone or in combination with resistors) to by-pass harmful voltage surges. No matter which arrangement is used in the receiver under consideration, the serviceman should be careful to connect the replacement buffer units into the circuit in exactly the same way as the original parts were connected. *This is important!*

Receiver Make & Model No.	*Capacity of Replacement Buffer Cond. —(Mfd.)*
ACRATONE	
32C, 33C	.01(2)
40	.025(2)
49, 51	.02(2)
92, 92A, 94A	.02
167B, 167D, 168B, 168D	.01(2)
460	.02
640	In Vib.
K6, L7	.01(2)
X6 Z, Z5	.01(2)
ADMIRAL	
6A, 6D, 512-6D	.01(2)
965-6P, BA, 41, L7	.01(2)
RPC, X6, X641, X741, Z4, Z5	.01(2)
F923 (L'Tatro)	.05
—(*Cont'd*)	

Receiver Make & Model No.	*Capacity of Replacement Buffer Cond. —(Mfd.)*
AIRCASTLE	
330P	.01(2)
603	.005
BA41, L7, X6, Z4, Z5	.01(2)
AIR-CHIEF (See also *Firestone*)	
66	In Vib.
AIRLINE	
54	.007
62-118, 62-166	.01
62-136, 62-138	.015
62-199	.007
62-202, 62-236, 62-242, 62-263	.0075
62-258	.0055
—(*Cont'd*)	

Receiver Make & Model No.	*Capacity of Replacement Buffer Cond. —(Mfd.)*
AIRLINE—(*Cont'd*)	
62-264, 62-280A, 62-280, -282, -284, -459, -552, -651, -652	.003
93BR657A, 93BR666A	.003
62,292, 62-294	.02
62-327, 62-331, 62-337	.01
62-334	.018
62-345	.005
62-363	.015
62-364	.008
62-369	.005
62-373, 62-374	.02
62-427, 62-437, 62-441	.01
62-463	.015
62-465	.005
62-553	.008
—(*Cont'd*)	

Receiver Make & Model No.	Capacity of Replacement Buffer Cond. —(Mfd.)
AIRLINE—*(Cont'd)*	
62-554	.008
62-650	.015
62-653	.008
62-750, 62-751, 93BR564A	.008
87	.04(2)
93BR666A	.003
199, 202	.01
670	.02
Auto Radio (O62)	.05
AIRMASTER	
31B, 34B, 49B, 50B	.02
73BA, 73BT, 96BCE, 96BTE, 119BC, 119BCT, 130BC, 130BT, 140BC, 140BT	.03
100XC, 100XT, 144XC, 144XT	.02
AIR MATE (See also *B.O.P.*)	
65	In Vib.
544267	In Vib.
ALL-AMERICAN MOHAWK (See *Wurlitzer*)	
ALLIED RADIO CORP. (See *Knight*)	
AMRAD	
F 546	.01
ANDREA	
(6 volt) 610, 611, 612, 613, (Chassis C6B)	.015(2)
(32 volt) 610, 611, 612, 613, (Chassis C32B)	.01
616, 617, 618, (Chassis D6B)	.015(2)
626, 627, 628, (Chassis E6B)	.015
ARCADIA (See *Wells Gardner*)	
ARVIN	
5	.01
6	.005
7, 8A	.02(2)
9A	.01
10A-1, 10A-2, 16	.02(2)
15	.02(2)
17A, 17B, 17C	.02(2)
18, 18FW	.01
19	.005
20A, 20B	.02(2)
22A	.01
25 (1st)	.02(2)
25 (2nd)	.02(2)
27	.02(2)
28, 28EM, 28OM	.005
29	.004
30A, 30B	.02(2)
32	.004
33, 33DM	.005
35	.02(2)
37	.02(2)
38	.005
39, 42	.004
45 (1st & 2nd)	.02(2)
61B, 62B	.005
517, 517B, 527B	.01
518B	.015
617, 617B, 627B	.01
ATWATER KENT	
126, 136	.003
132, 135Z, 138, 215Z	.05(2)
237Q, 237Z	.015(2)
265Z, 305Z	.05(2)
416, 446	.003
42, 534	In Vib.
467Q	.015(2)
556	.01(2)
565FF, 565Z	.05(2)
666, 776	.05(2)
816, 826	.05(2)
AUBURN	
A5A2	.01
A5A3	.005
980525, -526	In Vib.
AUDIOLA (See also *Fairbanks-Morse*)	
23ST (1st), 33S6 (1st), 33S7 (1st)	.05
23S7, (3rd), 33A6	.02
33S8 (1st)	.05
33S8 (2nd)	.04
43C1B, 43T1B, 73C2B, 73C3B, 73T3B	.01(2)
64	.02
—*(Cont'd)*	

Receiver Make & Model No.	Capacity of Replacement Buffer Cond. —(Mfd.)
AUDIOLA—*(Cont'd)*	
67	.01
74	.01
345, 346, 347	.02
6717, 6746	.01
B6	.02
C6	.02
Audiola 32 Volt	.06
AUTOCRAT (Horn)	
5	.008(2)
505, 518, 518S, 530, 618, 618S	.0075
6D32	.05(2)
AUTOMATIC	
A1, A5, A6	.02
J50, J60, J70, J80	.02
M10, M20, M30, M60, M67	.007
C-15, M70, M80	.008
AUTO-ROLA	
J50, J60, J70, J80	.02
BALKEIT	
GT 156 BA, 157BA, L7, X6, Z4, Z5	.01(2)
BELMONT	
408A	.003
415A, 415B, 489A, 504, 504A	.005
505A	.008
553A, 751A	.008
566, 567A	.01
577	.005
577A, 577C	.005
580	.01
611A	.003
661	.005
666, 666A, 666B, 667, 668	.01
670	.02
670A	.015
676A	.003
677	.01
680, 680A, 680B, 680C, 690	.01
751A	.008
804	.005
823-A	.01
880A, 880B	.01
880C	.015
881	.003
1932 Models	.05
BLACKHAWK	
6U, 64	.01
B. O. P. (Buick-Olds-Pontiac)	
393884, 544245, -246, -267, -268	In Vib.
980383, -393	.015
980441, -455, -459	In Vib.
BOSCH	
45A, 45C	In Vib.
78	.02
79, 79C	.008
140-A, 140-2, 140-3	In Vib.
150-1	.01
150-2, 160	In Vib.
178	.02
337, 524A	.008
536, 536B	.008
600	.008
634, 634A	.005
634A(2)	.008
636, 637	.008
735, 736, 737, 738	.005
818	.008
838, 858	.005
BUICK (See also *B.O.P.*)	
544245, -246	In Vib.
980383, -393	.015
980441, -455, -459	In Vib.
980507, -508, -509, -525, -529	In Vib.
980534, -535	.01(2)
980620 (1314523)	.015(2)
12913444, -345	In Vib.
1304873, -874 (980566, -567)	.01(2)
1308221 (980598)	.015(2)
CADILLAC-LaSALLE MOTOR CO.	
5X	.0055
6C, 6J, 6KB	.0055
6R	.0075
6S, SU2	.01
8C8	.01
O6W, O72A	.01
O72, 2721	.05
—*(Cont'd)*	

Receiver Make & Model No.	Capacity of Replacement Buffer Cond. —(Mfd.)
CADILLAC-LaSALLE—*(Cont'd)*	
2722	.01
1425470, -471	.0055
1433970 (C8)	.01
7232502	.01(2)
7238350	.01(2)
CAPTAIN (See *L'Tatro*)	
CAVALCADE	
54, 64, 359	.02
3511	.01(2)
CHAMPION	
5	.02(2)
501, 600	.01(2)
601	.01
Power Supply	.01
CHEVROLET (See also *B.O.P.*)	
364441	.015
600153	In Vib.
600249, -565, -566	In Vib.
601038	In Vib.
601176	In Vib.
601177	In Vib.
601525, -574	In Vib.
601586	In Vib.
601662, -814	In Vib.
985100	.0022
985200	.01
985252, -253, -254, -255	.005
985283, -284	.01(2)
985285	.005
985300, -301	.01
985400	.01
985424, 985426	.01(2)
985425	.0065
985536	.01(2)
985538	.004
CHRYSLER (See also *Philco (Chrysler)*)	
25C6	.018
C-1708	.002
CLARION (T. C. A.)	
TC 50	.015
CLIMAX	
66	.01
AKE	.01
CLINTON	
801, -2, -3, -4, -5, -6, -7, -8, -9	.01
COLONIAL	
106B	.02
134	.01
150	In Vib.
164	.01(2)
164 B	.01(2)
240	.01(2)
349 (F)	In Vib.
355, 359, 361	In Vib.
COMMANDER (See *L'Tatro*)	
CONSOLE (See *L'Tatro*)	
CONTINENTAL RADIO & TELEV.	
AZ 593, L7, M551, M587	.01(2)
X6, X641, X741, Z4, Z5, Z544	.01(2)
6D, 7A	.015
6P, 6PU, 7J	.01(2)
55	.006
66, 69, 77, 78, 88, 660, 770, 880, 950-6A, 965-6A	.0075
965-6P	.01(2)
CORONA	
212, 214	.01
CORONADO (Gamble-Skogmo)	
5C6, C6	.018
5Y	.007
6C1	.0075
6C7	.008
6J, 6JA, 6JB, 6K	.0055
6L	.0075
6U	.01
15C6	.018
28B5, 6B	.015
26R1	.0075
26S1	.01
(*Cont'd over*)	

Receiver Make & Model No.	Capacity of Replacement Buffer Cond. —(Mfd.)
CORONADO—*(Cont'd)*	
31BT, 34BT	.02
46L	.0075
49B, 49BT, 50B, 50BT	.02
73BA, 73BT, 96BCE, 96BTE	.03
100 XC, 100XT	.02
489	.005
500	.01
504	.005
566	.01
580	.01
666, 667	.01
670	.02
670-A	.015
677, 677A, 677B	.01
680	.01
803A, 803B	.005
880C	.015
6100, 6101	.02(2)
C6	.018
CROSLEY	
A5A2	.01
A5A3, A155	.005
A156	.005
A157	.01
A158	.0065
A166	In Vib.
A167	.005
A168	.0065
A-169	.0065
A177	.006
A255	In Vib.
A258	.0065
A267*	.01(2)
A268	.0065
A355	In Vib.
A366	In Vib.
A368	.0065
A455, A555	In Vib.
B46	.005
B587A, B667A, B667M	.0085
C159	.0085
4A1	.005
5A1	.01
5A3, 6B1	.005
98, 99, 101, 102	.01
103	.02
119, 159	.01
156	.01
416, 435, 546	.005
557 (C-44185)	.01
625	.005
636	.005
645	.01
DE FOREST CROSLEY (Canada)	
6D471	.015
DELCO (See also *Chevrolet, Buick, Oldsmobile, Pontiac, United Motors*)	
6-3	.015
500, 630	.01
625, 626, 627, 628, 629	In Vib.
631, 631A, 632, 633	.005
634	In Vib.
635	In Vib.
3203, 3204	.01
4049, 4050, 4051	.01
R640, R641, R643, R644, R644	.005
R642	.008
R663	.015
R665, R666, R667, R668, R669	.01(2)
R673 (Police)	.01(2)
R675, R677	.015(2)
R676	.0075
R678	.01(2)
R685	.015(2)
R686	.0075
R687, R688	.01(2)
R6010, R6015	.03
R6011, R6012	.01
DETROLA	
6A	.02
6M, 6R	.0075
111, 112, 166	.0075
144, 144B, 144C	.015
145B, 145CR	.01
1934-1935 Models (leads)	.02
6753	.005
DE WALD (See *Pierce Airo*)	
DOMINION ELECTROHOME	
V7-32-61-P, V7-32-62-P	.01
7V41-E	In Vib.

—(Cont'd)

Receiver Make & Model No.	Capacity of Replacement Buffer Cond. —(Mfd.)
DOMINION ELECTROHOME—*(Cont'd)*	
7V51-P, 7V51-M, 7V52-E, 7V62-P, 7V83-S	.006(2)
8V41-E, 8V41-E-1, 8V51-M, 8V51-P	.006(2)
ELECTRIC AUTO-LITE	
O62A	.05
O72A	.01
ELECTRONIC	
331	.02(2)
332	.02(2)
EMERSON	
AS 179	.02(2)
E, E123, E128	.0075
34F7, 101F7	.015(2)
P, P117, P135	.012(2)
U154	.0075
V155	.005
5A	In Vib.
6A	.008
667	.015
640, 678-1, 678-2	.02
965, 975	.02
EMPIRE	
60	.02
ERLA (See *Sentinel*)	
FADA	
101(RK), 102(RP), 104 104B(RV)	.01
166	.01
246	.05
266, 266SD, 266SF, 266SG	.007
267, 267SD, 267SF, 267SG, 267X	.004
1246	.007
FAIRBANKS MORSE (See *Audiola also*)	
4A, 4B, 6C, 6CC-2B, 6CT-4B, 43C1B, 43T1B, 73C3B, 73T3B	.01(2)
FEDERATED PURCHASER (See *Acratone*)	
FIRESTONE	
Trav-ler	.02
1121 (R112)	.02(2)
1182 (R118)	.015(2)
1314 (R131)	.03(2)
1322 (R132)	.005
1332 (R133)	.03(2)
1431 (R143)	.01
1781 (R178)	.01
7406-1, 7407-1	.005
7407-3, 7408-1	.005
S7407-5	.003
7407-6	.01
H7424	.005
S7424-3, S7428-1	.01(2)
FORD	
FT9	.01
F1440, F1540, F1542	.008
F1442	.0075
F1640	.0075
F-1740	.002
6MF490	.012(2)
40-18845	.02
40-18805, Glove-Box Police, Majestic	.008(2)
Lincoln, Marconi, Zenith	.02
FORDSON	
FP32V	.05(2)
FREED	
A9	.01
FRESHMAN (See *Belmont*)	
GALVIN MFG. CORP. (See *Motorola*)	
GAMBLE-SKOGMO (See *Coronado*)	

—(Cont'd)

Receiver Make & Model No.	Capacity of Replacement Buffer Cond. —(Mfd.)
GAROD	
2B6, 2B6-1, 3B6, 3B6-3	.01
GENERAL	
801, 802, 803, 804, 805, 806, 807	.01
GENERAL ELECTRIC	
B40, B52, C41	In Vib.
C60	.02(2)
C61	In Vib.
D50, D51, D52	.02(2)
D72	.02(2)
FA60, FA61, FA80	.02(2)
FB53, FB57, FB73, FB77	.03(2)
K6M, K7M	.0075
M51, N51	.0055
6BK, 6BT	.02(2)
6M2	.01(2)
N60	.0075
U51, U55	.01
U70, U75	.01
GENERAL HOUSEHOLD UTILITIES (See *Grunow*)	
GENERAL MOTORS (Canada)	
134, 135	In Vib.
136, 137, 138	In Vib.
540, 640, 641	In Vib.
GILFILLAN	
7A, 700	.015
8X	.01
G. M. TRUCK	
7233966	.005
7233967	.01(2)
GOLDENTONE, GOLD MEDAL	
L7, X6, Z4, Z5	.01(2)
TA	In Vib.
GOODRICH	
50, 65	.01
60	.008
80, 90	.005
670	.02
GOODYEAR (Wings) See *Belmont* Also	
504A	.005
580	.01
661	.005
666	.01
667	.01
670	.02
01018	.015
01019 (661)	.005
01554 (505)	.008
010110 (667)	.01
015120. 015121	.009(2)
015110, 015111	.004
015130, 015131	.012
01029 (415A, 415B, 489)	.005
010221 (804)	.005
100502	.01
101500	.005
101501, 101502	.005
GOVERNOR (See *L'Tatro*)	
GRAHAM (GRAHAM-PAIGE)	
A355, A555	In Vib.
G1418, G1528	.0075
G1436	.008
G1528	.0075
GRAYBAR	
150-2	In Vib.
GREBE	
61R	.025
GRIGSBY-GRUNOW (See *Majestic*)	
GRUNOW (General Household Utilities)	
410, 411 (4NB), 711, (7NB)	.0075
614, 618	.005
625	In Vib.
1936 Household Models	In Vib.
GULBRANSON (See *Wells-Gardner*)	

—(Cont'd)

Receiver Make & Model No.	Capacity of Replacement Buffer Cond. —(Mfd.)
HARLEY-DAVIDSON	
EG 45A, M17815	.005(2)
YA	In Vib.
670, Highwayman	.015
HORN (See *Tifany Tone*)	
HOWARD	
HA 1	.015
HA 2, 52, 502	.008(2)
HA 3, HA 4	.015(2)
HA 6	.005
H7424-3, 68B	.005
6B, 6BA, 6BT, 7BT	.005
HUDSON-TERRAPLANE	
CB6, DB37, DB38, SA37, SA38	.01(2)
SA39, SA40	.01
H6	.02
650, 650HD, 651HE, 660, 660TD, 661TE	.02
666, 668, 680	.01
114300	.01
HUPMOBILE (See *Philco*)	
INTERNATIONAL (Kadette)	
K6, K60	.02
JOHN HOLMES	
3 Lead	.02
KADETTE (See *International*)	
KARADIO	
55 (Police)	.015
56, 57, 57B	In Vib.
65, 66, 67, 67S, 75, 76, 77, 77S, 88	.01
667	.007(2)
KENNEDY	
670	.02
KNIGHT	
A9728, A9729, A9730	.01
A9776, A9777, A9778 (Z5)	.01(2)
A9780, -1, -2, -3, -4, (B7(, A9880)U6)	.0075
A10508 (6P)	.01(2)
B10600, B10608	.03
E10719, E10720, E10721	.01(2)
E10725	.008(2)
E10727	.01(2)
E10751	.006
E10752	.0075
E10786	.03(2)
E10790	.03
E10825, E10826, E10827, E10828, E10829, E10830, E10831, E10832	.01(2)
E10882, E10883, E10884, E10885, E10886, E10887	.03(2)
E10890	.006
E10891	.0075
E10906, E10907	.03
F9451, F9515, F9541	.05(2)
F9561	.05
F9777	.01(2)
G9515, G9517	.02(2)
G9599	.05(2)
G9615	.01(2)
G9875, G9876	In Vib.
G9881, G9882, G9900	.02(2)
H9817	In Vib.
H9876	In Vib.
6820, 6826	In Vib.
LAFAYETTE	
AM20	.015
B52, B62	.007
C60	.025(2)
J60	In Vib.
LW10	.025(2)
L30	.01
L17762	.01
M44	.01(2)
O62, O62A	.05
S17762	.01
25, 9682	In Vib.
LAFAYETTE (Nash-Lafayette) (See *Philco or Nash-Lafayette*)	
LARKIN	
16, 90, 91	.015
LA SALLE (See *Cadillac-LaSalle*)	
LEWOL	
9682	In Vib.
LIEUTENANT GOVERNOR (See *L'Tatro*)	
LINCOLN, LINCOLN-ZEPHYR	
L1420, L1424, L1425, L1427, L1429, L1460	.008
L1560	.0075
LT14X3, LT14X4	.01
Utah Pack	.02
L'TATRO	
C625, C925	.005
CQ-69	.005
D625, D925	.005
DQ-69	.005
EN6-4	.005
E83	.05
EQ-39	.01(2)
F	In Vib.
F283	.05
F725	.005
F913, F923	.05
FQ-39	.01(2)
H465, 1455, 1465	In Vib.
HQ-39	.02(2)
IN-25	.02(2)
L54	.01
L4616, M4616	In Vib.
N54	.01
N4616	In Vib.
NO-85	.005
NQ-69	.005
O4626, O5636	In Vib.
OO-65	.005
P4626, Q4626, Q5636, R5236, R5636, S5636, S6636	In Vib.
SP-67	.005
T6216, U5226, V5226, W6236, X6236, Y6236	.005
TP-67	.005
5A, 6A	In Vib.
MAJESTIC	
6M471	.015
490, 491, 493: Replacement Head	.008(2)
MALLORY (Eliminators)	
Types 1 to 6	.05
Types 10 to 14	.01
Type 60	In Vib.
VP-551, -552	.005
VP-553, -554	.005
VP-G556	.005
MARCONI (Canada)	
5, 6 (Power Units)	.01
40, 42	In Vib.
93, 94	.005
118	.008(2)
165	.005
291, 294	.006
MIDWEST	
5-36	.01(2)
6-37	.025(2)
7-36	.02
7-37	.02
7-38, 8-38, 12-38	.015
MISSION BELL	
10A	.02
11, 12, 14, 25A	.05
16, 17, 18	.006
19, 19A, 19B	.05
MONARCH	
L7, X6, Z4, Z5	.01(2)
MONTGOMERY WARD (See *Airline*) —(Cont'd)	
MOTOROLA	
8-30, 8-40, 8-50, 8-60	.01
8-70, 8-80	.005
8T38	.05
15F, 22S, 25N	.006
16C, 18-0, 26C, 29B-6	.01
17D, 17D-A	.007
19B, 700	.005
20P, 21L, 24K, 26C7, 27D, 28-O, 30P	.007
29B	.006
34	.02
35	.01
35N	.01
44	.01
44A	In Vib.
45	.01
49BR2	.02
50	.01
55, 55A	.01
57	.01
60	.008
61	.05
62	.01
65	.01
66, 66A	In Vib.
70	.005
75	.01
77	.01
77A, 77A-B	In Vib.
79	.01
80	.005
88	.05
90	.005
100, 110	.01
250	.008
300	.01
350	.008
400	.01
450	.007
500	.01
924	.006
929	.006
944, 949	.01
969	.005
Companion	.01
Dual Six (D6)	.01
Golden Voice	.005
Super 6(S6)	In Vib.
Twin Eight (T8)	.01
Police	.0125
P-6912, P69-13, T-69-20	.006
P-69-14	.01
P-69-17	.005
T-69-20	.003
MOTOSET (See *Fada*)	
MUSICAIRE	
5C001, 5T001, 441XC, 441XT	.02
5T37, 6CE69, 6TE69, 031CE, 031T	.03
31B, 34B, 50B	.02
041BC, 041BT, 49B, 911C, 911T	.03
NASH-LAFAYETTE Also see *Philco* (*Nash-Lafayette*)	
AC989, AC989(122)	.006
AC1089	.01
AC1189, AC1289, AC1989	.01
AC3689	.015(2)
AC3789	.0075
AC4289 (6MN496)	.007
AC4389 (6MN495)	.006
C(NCD), D(NDD)	.006
D-122 (NDD-122)	.01
J(NJD), J-122 (NJD-122)	.01
NT7, NT8	.01
NT12X, NT12X2, NT15, NT15X	.01
N1418	.0075
N1433H, N1434H	.008
N1514, N1524	.0075
Q (NQD)	.01
NOBLITT SPARKS (See *Arvin*)	
NORTHERN ELECTRIC	
33, 40	In Vib.
61	.02

(Cont'd over)

Receiver Make & Model No.	Capacity of Replacement Buffer Cond. —(Mfd.)
OLDSMOBILE (See also *B.O.P.*)	
393884, -885, 405045, -046, -057, -062	In Vib.
405063	In Vib.
980383, -393	.015
980441, -455, -459	In Vib.
982006, -007, -008	In Vib.
982043, -044, -045, -083, -084	.005
982085	.01(2)
982127	.0075
982153	.005
982160	.004
982161	.01(2)
982126, 982153	.005
PACIFIC	
H6, H7	.008
6V	.01
21, 22, 23, 80	.01
25	.01(2)
101	.01(2)
102	.01
682, 9682	In Vib.
PACKARD BELL	
75, 76, 78	.005
PACKARD MOTOR CO. (See *Philco* also)	
PA-333195, PA-351099, PA-351100 (R3271, R3271C) PA-351101, PA-351102, (R3291, R3291C)	.001
PB, PBD	.006
PHD (H122), PHXD	.01
PT5	.01
PT14	.01
P1417, P1517, P1530, P1535, P1617, P1630, P1635	.0075
P1421, P1422, P1426, P1430, P1332H, P1439	.008
PACKARD RADIO CO.	
6	.05(2)
PHILCO	
AC206	.006
AC206 (122)	.01
AC236	.01
AC266	.01
AC989, AC989 (122)	.006
AC1089	.01
AC1189, AC1289, AC1989	.01
AR-1	.015
AR-4, AR-6, AR-7	.003
AR-8	.0075
B (PBD)	.006
C (NCD, SCD), C122 (SCD122)	.01
CGD (G)	.006
CGD122 (G122)	.01
CRD (R), CRD122 (RA22)	.01
CT2, CT5	.01
CT10, CT11	.01
C122 (SCD122)	.01
(Chrysler) C1423, -50, -52, C1540, -42	.008
C1550, C1608	.0075
C1608 (change)	.0075
C-1708	.002
D (NDD, SDD)	.006
DP, DPV	.01
D122 (NDD122), E (MED)	.01
EF, EG	.006
E122 (MED 122)	.01
FND (N), FT6	.01
FT9	.01
(Ford) F1440	.008
F1442	.0075
F1540, F1542	.008
F1640	.0075
F-1740	.002
G (CGD)	.006
G122, (CGD122, HGD122)	.01
(Graham) G1418	.0075
G1436	.008
G1528	.0075
HGD 122 (G 122)	.01
H (HHD), H122 (HHD 122, PHD)	.01
(Hupmobile) HRD (R), HRD 122 (R122)	.01
HT11X	.01
J (NJD), SJD	.01
J 122 (NJD 122, SJD 122)	.01

—(Cont'd)

Receiver Make & Model No.	Capacity of Replacement Buffer Cond. —(Mfd.)
PHILCO—*(Cont'd)*	
(Lincoln, Lincoln-Zephyr) LT14X3, LT14X4	.01
L1420, L1424, L1425, L1427, L1429, L1460	.008
L1540, L1660	.0075
N(FND)	.01
(Nash-Lafayette) NCD(C), NDD(D)	.006
NDD 122 (D122)	.01
NJD(J), NJD 122 (J 122)	.01
NT7, NT8	.01
NT12X, NT12X2, NT15, NT15X	.01
NQD (Q)	.01
N148	.0075
N 1433H, N 1434H	.008
N 1514, N 1524	.0075
(Packard) PB, PBD	.006
PHD (H122), PHXD	.01
PT5	.01
PT14	.01
P1417	.0075
P1421, P1422, P1426, P1430 P1432H, P1439	.008
P1517, P1530, P1535	.0075
P1617, P1630, P1635	.0075
(Pierce-Arrow) ME	.006
MED (E), MED 122 (E122)	.01
MT3	.01
MT 14X4	.01
Q (NQD, SQD)	.01
R (CRD, HRD), R122 (CRD122, HRD122)	.01
(Reo) RT3 (5485)	.01
RT14X	.01
R1415	.0075
(Studebaker) SCD(C), SCD122 (C122)	.01
SDD (D)	.006
SJD (J), SJD122 (J122), SQD(Q), ST3	.01
ST12, ST15	.01
S1416	.0075
S1431, S1437	.008
S1516, S1526	.0075
S1616	.0075
S1622	.006
S1626	.0075
S-1726	.002
T2, T3, T5, T6	.01
T7, T8, T9, T10, T11, T12, T12X, T14, T14X, T15, T15X	.01
(Willys) W1419	.0075
5, 6F	.006
10, 10(122)	.01
11, 11(122)	.01
37-34, 37-624, 37-3624B, 37-3634X	.01
38-C624T, 38-C625X	.01
38-35	.015
38-39	.01
38-40	.015
624, 624B, 624H, 624R	.01
700	.01
800, 800(122), 802, 805, 806, 808, 809	.01
810PA, 810PB, 810PV (Police)	.01
811PA, 811PB, 811PV (Police)	.01
816, 816B, 816C, 816P	.01
817, 817B, 817C, 817P, 818, 818K, 819, 819H	.0075
821P, 821PV (Police)	.006
826, 827, 827K	.0075
828, 828K	.006
920, 921, 922	.0075
926, 927, 928K	.0075
931, 933, 936, 937, 938K	.0075
PIERCE AIRO (Dewald) (United Scientific)	
A604, A605	.025(2)
A607LW (6 volt)	.0075
61, 61X	.025
517, 517R, 527	.01
605, 606, 607, 617	.025(2)
640	.025(2)
702	.01
PIERCE-ARROW (See *Philco*)	
PILGRIM	
DB, DF, DFE	.01
GB, GF	.01

Receiver Make & Model No.	Capacity of Replacement Buffer Cond. —(Mfd.)
PILOT	
G-56, G-57	.006
H-64, H6204 (H-6200)	.01
253 (1st), 255 (1st)	.01
PLA-RIGHT	
500	.01
PLYMOUTH (See *Philco*)	
PONTIAC (See also *B.O.P.*)	
544245, -246, -267, -268	In Vib.
544289, -290A, -291A	In Vib.
544290(ser. O), 544291(ser. O), 544297, -298	In Vib.
980383, -393	.015
980441, -455, -459	In Vib.
983506, -507	In Vib.
983526, -527, -534, -569	.005
983570	.01(2)
983616, 983617	.005
983667	.015(2)
983679	.01(2)
7232553	.01(2)
POWERTONE	
500	.01
PRESIDENT (See *L'Tatro*)	
RADIART	
3310, B Eliminator	.02
3311, 3312, 3314	.02
3316	.02
Vipowers: 4200B, 4200CF, 4202	.005
4200B-12, 4200CF-12, 4202-12	.005
4200B-32, 4200CF-32, 4202-32	.005
4201	.0075
4201-12	.0075
4201-32	.0075
4203	.0075
4203-12	.0075
4203-32	.0075
4204, 4204-F	.0075
4204-12, 4204F-12	.0075
4204-32, 4204F-32	.0075
Shaverpaks: S6A, S6B	0.1
S12A, S12B	0.1
S32A	0.1
RADIOMASTER (See *Admiral*)	
RADIO PRODUCTS CORP.	
L7, X6, Z4, Z5	.01(2)
U6, 46	.005
6D, 7A	.015
55	.006
RADOLEK	
10968	.05(2)
RCA-VICTOR	
AR4229	In Vib.
BC6-6, BT6-5	.01(2)
CB6	.01(2)
CV8	.01(2)
DB37	.01(2)
EG37A1	.02(2)
H6	.02(2)
IB23914	.02(2)
M34	In Vib.
M50, M60, M70 (RC357J, RC357K, RC394)	.0075
M101, M104	.02(2)
M105	In Vib.
M107	.02(2)
M108	.02(2)
M109	.02(2)
M116	In Vib.
M123	In Vib.
M112754	.005
5M	.01(2)
6BK6, 6BT6	.02(2)
6M, 6M2	.01(2)
8BK6, 8BT6	.02(2)
8M, 8M1, 8M2	.0075
8M3, 8M4	.01(2)
8QB, 8QBK, 9M1, 9M2 (RC357A)	.0075
67M	.01(2)
67M1, 67M2, 67M3	.01(2)

—(Cont'd)

Receiver Make & Model No.	Capacity of Replacement Buffer Cond. —(Mfd.)
RCA-VICTOR—*(Cont'd)*	
84BT6 (RC283)	.01(2)
85BT6 (RC316)	.01(2)
95BK6, 95BT6	.01(2)
V6-1	.02(2)
Imperial	.0075
Royal	.0075
(Aviation Receivers)	
AVR-7, -7A, -7B, -7C	.02
AVR-7D, -7E, -7F, AVR-8, -8A, -8B, -8C, -8D, -8E	.02
AVR10	.02
AVT-7, -7A, -7B	In Vib.
RECORDER (See *L'Tatro*)	
RELIANCE	
L7, X6, Z4, Z5	.01(2)
ROGERS (Canada)	
6R471	.015
ROMACO	
B Eliminators, 5, 8	.015
SEARS ROEBUCK (See *Silvertone*)	
SENTINEL	
7M, 10M, 10MF	.02
11M	.02
31B, 31B72, 31B74, 34B, 34B71, 34B74, 34M73, 49B, 50B	.02
73BA, 73BT, 78B, 96BCE, 96BTE	.03
100XC, 100XT	.02
119BC, -BT, 130BC, -BT, 140BC, -BT	.03
144XC, 144XT	.02
500, 503, 560, 600, 601, 602	.02
603	.005
4400	In Vib.
5500	.01(2)
5600	.01(2)
6100, 6101, 6102	.02(2)
SHELLY	
67, 75	.005
SILVERTONE	
107HA62	.005
470 (101.476)	.012(2)
1855	.05(2)
1855A	.05(2)
1859, 1859A	In Vib.
1949	.03
1949A	.015
4128	.01(2)
4400A	.005
4405	.006
4405A	.012(2)
4406, 4407	.006
4418	.01
4419	.02(2)
4421 (104.127)	.01
4428	.006
4428A	.012(2)
4430	.01
4433	.012(2)
4434 (104.127)	.01
4441	.02(2)
4448	.006
4448A	.012(2)
4450	.006
4451	.02(2)
4453	.012(2)
4459, 4519	.02(2)
4521 (104.127)	.01
4528A	.012(2)
4548, 4550	.006
4548A	.012(2)
4559	.02(2)
4600, 4601, (101.458)	.005
4613	.01
4614 (101.497)	.006
4622 (100.179), 4623 (100.157)	.01
4640 (100.476)	.012(2)
4643 (100.157)	.01
4650 (101.476)	.012(2)
4651 (101.497)	.012
4700	.01
4722 (100.179), 4723 (100.157)	.01
4740 (101.476)	.012(2)

—(Cont'd)

Receiver Make & Model No.	Capacity of Replacement Buffer Cond. —(Mfd.)
SILVERTONE—*(Cont'd)*	
4743 (100.157)	.01
4750 (101.476)	.012(2)
6073 (101.528), 6074 (101.515)	.012
6005 (101.507)	.009(2)
6070 (100.199)	.01
6071, 6072, 6076, 6077 (101.507) (101.513)	.009(2)
6100, 6101	.005
6170 (100.199)	.01
6171, 6172, 6176 (101.507) (101.513)	.009(2)
6173 (101.528)	.012
6301	.0075
7117	In Vib.
7128	.01(2)
7157, 7167	.03
SIMPLEX	
GB, GBE	.01
P32	.05(2)
Q	.01(2)
T	.05(2)
TA(1&2), T-2	In Vib.
SKY-RANGER	
500	.01
SOBOL	
6C2	.0075
SOLAR	
O62	.05
SONORA	
M, Q, QA	.01(2)
SPARTON	
33, 33A, 33B, 333, 535	.02
36	In Vib.
638-6, 688-6	.009
676, 686, D686, H686	.009
649-6L, 649-6S	.009
SPIEGEL	
L7, Z5, 144, 152, 167, 178, 182, 183	.01(2)
102, 104, 112, 114, 124, (Z4)	.01(2)
169(HI)	.005
186	.0075
1108, 1109, 1110, 1111 (211)	.01
1901, 1907, 1911, 1921, 1932, 1955, 1957, 1961, 1981(X6, BA41)	.01(2)
2212 to 2215, 2254 to 2257, 2280, 2281 (145E)	.01
2222 to 2229 (73B)	.03
4400, 4404, 4420, 4452 (6P-75)	.01(2)
4519, (603)	.02
5200, 5210, 5214, 5216, (651)	.01(2)
5218, 6712, 6716, 6766, 6772 (14-129)	.01
5256, 5260 (700)	.0075
5300, 6800	.0075
6708, 6750, 6752, 6754, (M5, Z4)	.01(2)
6760, 6770 (700)	.0075
6805 to 6808, 6815 to 6818, 6836	.0075
9930 (25Y)	.007
STAR	
O62, O62A	.05
6U	.01
STEWART RADIO	
60	.02
STEWART WARNER	
1121, 1122, 1123 (R112)	.02(2)
1171, 1172 (R117)	.015(2)
1181, 1182, 1183 (R118)	.015(2)
1311 to 1319 (R131)	.03(2)
1322 (R132)	.005
1132, (R133)	.03(2)
1431 (R143), 1601 to 1609 (R160)	.01
1631D to 1639D (R163, R163D), 1641D to 1649D (R164, R164D)	.005
1781 (R178), 1871 (R187)	.01
1841 (R184), 1891, (R189), R187	In Vib.

—(Cont'd)

Receiver Make & Model No.	Capacity of Replacement Buffer Cond. —(Mfd.)
STEWART-WARNER—*(Cont'd)*	
1911, 1915 (R191D), 1921, 1925 (R192D)	.03
1955 (R195)	.006
3211, 3212 (R321)	.01
R198, R199	.015
R402	.015
4181, 4185, (R415, R418)	.01
ST. REGIS	
K6, K60	.02
STROMBERG CARLSON	
33, 33A, 33X, 34	.01
115	.005
STUDEBAKER (See *Philco*)	
S-1726	.002
SUPERTONE PRODUCTS INC.	
L7, X6, Z4, Z5	.01(2)
TATRO (See *L'Tatro*)	
TERRAPLANE (See also *Hudson-Terraplane*)	
DB-37	.01(2)
TIFFANY TONE (Herbert Horn)	
535	.03
TIGER	
26S1	.01
670	.02
670A	.015
TRANS. CORP. OF AMERICA (T.C.A.) (See *Clarion*)	
TRANSITONE (See *Philco*)	
TRAV-LER	
54	.02
76	.01
173	.005
525	.006
542	.01
560	.015(2)
642	.01
733	.005
6 Tube Auto	.008
6, 8 Tube Batt. or AC	.012(2)
TROPIC AIRE	
O6W	.01
TROY	
TR68	.01
T86	.01
TRUETONE	
D690, D691, S690, S691	.05
D706	.005
D718	.01(2)
D734	.005
D735	.007
D745, S745	.0055
D746, D976	.008
D1091, D748	.008
S735	.007
S740	.01
S743, 1312 (R131)	.03(2)
6S, 6U	.01
670	.02
TRUEVALUE	
6U	.01
ULTRAMAR	
856, 857	.012(2)
UNITED AMERICAN BOSCH (See *Bosch*)	

(Cont'd over)

Receiver Make & Model No.	Capacity of Replacement Buffer Cond. —(Mfd.)
UNITED MOTORS (See also *Delco*)	
66	.008(2)
4036	.015
4037, 4038	In Vib.
4049, 4050	.01
UNITED SCIENTIFIC (See *Pierce Airo*)	
UNIVERSAL BATTERY CO.	
802, 803	.01
7232, 7332	.01(2)
UTAH	
Non-Sync. Pack	.02
WALGREEN	
34B	.02
550	.0075
WARWICK	
9-59	.005
511	.0075
553	.008
550, 560	.0075
559, 579	.0038
600	.01
618	.0075
646	.005
651	.01(2)
751, 761	.01(2)
WELLS GARDNER	
B2A	.02
C5	.0055
C6A, C6B	.018
C7, C11	.008
O6W	.01
O6Z	.04(2)
O62, O62A	.05
S1	.01
S2	.015
V6Z2	.04(2)
Z6R1	.0075
Z6S1, Z6U1	.01
Z6Z1	.04(2)
5C6	.018

—(Cont'd)

Receiver Make & Model No.	Capacity of Replacement Buffer Cond. —(Mfd.)
WELLS GARDNER—*(Cont'd)*	
5C10	.008
5H, 5K1	.01
5S3 Chassis	.003
5X	.0055
6C1	.0075
6C7, 6C9	.008
6C13, 6C14	.008
6CH5, 6J, 6KB	.0055
6K	.0055
6L, 6N, 6R	.0075
6S, 6U	.01
7C15	.008
7Q, 7S	.01
15C6	.018
25Y1 (5Y)	.007
26B1 (6B)	.015
26S1, 26U1	.01
36C7, 36C11	.008
46J3	.0055
65H, 106S2-714, 106S2-768	.01
WESTERN AUTO (See *Truetone*)	
WESTINGHOUSE	
A43, A44	In Vib.
WR25, WR26	.02
WR33, WR41, WR42	In Vib.
WR500, WR501	.008
WHOLESALE RADIO (See *Lafayette*)	
WILCOX-GAY	
A5, A6	.015
3R6	.02
4B6, 4B6-2	.015
WILLYS-OVERLAND (See *Philco*)	

Receiver Make & Model No.	Capacity of Replacement Buffer Cond. —(Mfd.)
WURLITZER	
A60, 460	.02
U50, U500	.05
ZENITH	
4B106, -131, -132(5406), -231(5409), -313(5410), 314, 317(5411), -355(5410)	.01(2)
4F133 (5407)	.01(2)
4V31, 4V59, (5405)	.01(2)
5F134, 5F166 (5518)	.01(2)
5J217, 5J247, 5J225, (5524)	.02(2)
5M90 (5510)	.01
5M191 (5520)	.008
5M291 (5527), 5M294 (5530)	.006
6B107, 6B129, 6B164 (5535), 6B231 (5653)	.01(2)
6J230, 6J257(5642), 6J322, 6J357(5654)	.02(2)
6M90D, 6M90S(5630), 6M91D, 6M91S(5631), 6M92(5632)	.008
6M192, 6M193, 6M194 (5637)	.008
6M292, 6M293 (5645), 6M295 (5650)	.006
6VA27, 6VA62, (5629)	.01(2)
6MF490 (Ford)	.012(2)
6MN495 (Nash)	.006
6MN496 (Nash)	.007
6V27, 6V62 (5821)	.01
7	.015
7J232, 7J259(5711), 7J323, 7J368 (5715)	.02(2)
7M91D, 7M91S (5706)	.008
8M195 (5803)	.008
460 (2047)	.02
462 (2057), 650HD, 651HE, 660TD, 661TE (2057)	.02
663 664 (5510), 666 (5616) 668 (5626), 690 (5617)	.01
ZEPHYR (See *Lincoln-Zephyr*)	
ZEPHYR RADIO CO.	
TA	In Vib.
20A6, 20B6, 20P6, 21A6, 21B6, 21P6, 22A6, 22B6, 22P6	.01
30B7	.01

—— END ——

CHART OF RECOMMENDED "REPLACEMENT," & "ELECTRICALLY-COMPARABLE" BATTERIES FOR 1250 MODELS OF PORTABLE RADIO RECEIVERS

[Lists by a "Key-Number" Chart System, the Mnfr's. Type Numbers of all the Comparable Batteries (of 23 Leading Makes) for Replacement in 1250 Models of 100 Makes of Portable Battery-Operated Radio Receivers]

This chart has been compiled to assist radio dealers and service men in determining the proper replacement batteries for the various models of portable radio receivers—whether these replacement batteries are to be of the same make as those originally supplied with the receiver, or whether they are to be comparable batteries of another make which the dealer or serviceman prefers to handle or finds more readily obtainable. The battery data for approximately 1250 Models of 100 Makes of portable receivers is presented here. The author wishes to acknowledge here with grateful appreciation the enthusiastic cooperation of the Engineering Departments of the various battery manufacturers in supplying the mass of technical data from which this chart has been compiled. It has been checked and cross-checked and is believed to be more complete and free from errors than any receiver battery chart heretofore published.

Simplified "Key" System used in Charts

A simplified reference "Key" system, which it is believed was first used for a similar purpose in the 1940 Radio Today Yearbook has been employed in this chart.

To determine the catalog numbers of the replacement batteries required, proceed as follows: Look up the *"Receiver Make & Model No."* in this first chart, and note the *"Key Designation"* numbers specified for the "A" and "B" (or "AB" pack) batteries required. (The number enclosed in parenthesis indicates the *quantity* of each battery required.) Now look up these battery *"Key Designation"* numbers in the charts on page 556. In the column under each of the "Key" numbers will be found the catalog numbers of the batteries of various manufacturers which may be used for replacement. For example, suppose it is desired to find the catalog numbers of the proper Eveready replacement batteries for an Admiral Model 335-4Z receiver. Referring to the chart below, we find that this receiver requires (*one*) *"Key" A7* "A" battery and (*two*) *"Key" B1* "B" batteries. Looking up these *"Keys"* in the chart on page 556, we find that the replacement may consist of *one* Eveready #743 "A" battery, and *two* Eveready #762 "B" batteries—or *electrically comparable* batteries of other manufacturers (the batteries listed in these same vertical columns).

Comparable Batteries

Note that all the batteries listed in the vertical column under any one "Key" on page 556 are considered as being *electrically comparable*. For example, in the column under the A3 key, we find that the Acme #114, Advance #247, Bond #4826, Bright Star #462, Burgess #4F, Eveready #742, etc., are all comparable, and may be used interchangeably in most cases. However, it must be remembered that there is often as much as a ½" difference in one or more of the dimensions of batteries of various manufacturers which are considered as being *electrically* comparable. Therefore, whenever it is desired to use comparable batteries of another manufacturer for replacement purposes, it is well to first check their actual dimensions from the Battery Dimensions & Electrical Specifications Chart in *Section 15* of this *Handbook* in order to make sure they will fit into the space available without harmful jamming or squeezing. Judgment should therefore be exercised when selecting electrically comparable batteries from the chart.

Receiver Make & Model No.	*Battery Quantities and "Key Designation" Numbers (to be referred to charts on page 556)*
ADMIRAL	
4A	(1) AB23
4B	(1) AB23
4D	(1) A7 (2) B1
F5	(1) AB9
XF5	(1) AB9
P5	(1) AB9
XP5	(1) AB9
G6	(1) AB9
XG6	(1) AB9
P6	(1) AB9
XP6	(1) AB9
10A5	(1) AB23
24A5	(1) AB23
27G4	(2) A18 (1) B5
28G5	(2) B18 (1) B5
33F5	(1) AB9
	—(*Cont'd*)

Receiver Make & Model No.	*Battery Quantities and "Key Designation" Numbers (to be referred to charts on page 556)*
ADMIRAL—(*Cont'd*)	
34F5	(1) AB9
34G6	(1) AB9
35G6	(1) AB9
36H5	(1) AB9
37G6	(1) AB9
39A4	(1) AB23
40A4	(1) AB23
41B4	(1) AB23
51D4	(1) AB17
76P5	(1) A4 (2) B4
L76P5	(1) A4 (2) B4
77P5	(1) A4 (2) B4
78P6	(1) A7 (2) B1
79P6	(1) A7 (2) B1
104-4A	(1) AB23
141-4A	(1) AB23
	—(*Cont'd*)

Receiver Make & Model No.	*Battery Quantities and "Key Designation" Numbers (to be referred to charts on page 556)*
ADMIRAL—(*Cont'd*)	
151-4A	(1) AB23
164-4D	(1) A7 (2) B1
204-4A	(1) AB23
206-4J	(1) AB23
228-4C	(1) AB23
231-4F	(1) A3 (2) B4
231-4Z	(1) A3 (2) B4
236-5N	(1) A5 (2) B1
241-4A	(1) AB23
306-4J	(1) AB23
311-4D	(1) A7 (2) B1
319-4Z	(1) A4 (2) B4
331-4F	(1) A3 (2) B4
335-4Z	(1) A7 (2) B1
336-5N	(1) A5 (2) B1
351-4A	(1) AB23
	(*Cont'd on next page*)

Receiver Make & Model No.	Battery Quantities and "Key Designation" Numbers (to be referred to charts on page 556)
ADMIRAL—*(Cont'd)*	
451-4A	(1) AB23
504-4A	(1) AB23
516-4B	(1) AB23
541-4A	(1) AB23
606-4J	(1) AB23
635-4Z	(1) A7 (2) B1
636-5N	(1) A5 (2) B1
1035-4Z	(1) A7 (2) B1
1036-5N	(1) A5 (2) B1
AEOLIAN	
BP 4	(1) A3 (2) B2
BP 5	(1) A3 (2) B2
BP 6	(1) A13 (2) B1
BP 8	(1) A3 (2) B2
BP 10	(1) A13 (2) B1
BP 36	(2) A1 (2) B2
BP943	(1) AB10
AIR CASTLE	
KD	(1) A11 (2) B1
4D	(1) A19 (2) B1
F5	(1) AB9
XF5	(1) AB9
5N	(1) A5 (2) B1
BP11	(1) A11 (2) B1
BP12	(1) A5 (2) B1
18	(1) A3 (2) B1
T40	(4) A18 (1) B13
IBR 50	(1) A6 (2) B1
KD 73	(1) A11 (2) B1
130	(1) A7 (2) B1
178	(1) A19 (2) B1
1B350	(1) A6 (2) B1
506-1	(1) A7 (2) B1
553	(1) AB19
554	(1) AB19
0557	(1) A11 (2) B2
560-1	(1) A9 (2) B2
561-1	(1) A9 (2) B2
561-1M	(1) A9 (2) B1
591	(1) A6 (2) B1
591-1	(1) A6 (2) B2
611-1	(1) A9 (2) B2
900	(1) A3 (2) B1
1555	(1) A3 (2) B1
2122	(1) A5 (2) B1
2132	(1) AB9
2134	(1) A11 (2) B1
2148	(1) A11 (2) B1
2861	(1) A19 (2) B1
2952	(1) A19 (2) B1
5122	(4) A18 (1) B13
6622	(1) A3 (2) B1
AIR CHIEF (see *"Firestone"*)	
AIR KING	
444	(2) A18 (1) B5
3905	(1) AB10
3906	(1) A9 (2) B2
3910	(1) A9 (2) B2
3912	(1) AB10
3916	(1) A7 (2) B2
3950	(1) A12 (2) B2
4012	AB1
4016	(1) A12 (2) B2
4112	(1) A12 (2) B1
AIRLINE	
6B7	(2) A1 (2) B1
62-403	(1) A3 (2) B1
62-407	(1) A4 (2) B4
62-454	(1) A3 (2) B1
62-454A	(1) A9 (2) B1
62-455	(1) A9 (2) B1
62-461	(1) A4 (2) B4
62-462	(1) A3 (2) B4
62-464	(1) A4 (2) B4
62-555	(1) A3 (2) B1
62-557	(1) A9 (2) B1
62-565	(1) A9 (2) B1
62-566	(1) A6 (2) B4
62-569	(1) A6 (2) B4
62-663	(2) A1 (2) B1
04WG663	(2) A1 (2) B1
62-668	(2) A1 (2) B1
04WG668	(2) A1 (2) B1
62-672	(2) A1 (2) B1
680	(1) AB20
62-1435	(1) A9 (2) B1

—(Cont'd)

Receiver Make & Model No.	Battery Quantities and "Key Designation" Numbers (to be referred to charts on page 556)
AIRLINE—*(Cont'd)*	
62-1461	(1) A4 (2) B4
A-1461	(1) A4 (2) B4
62-1461	(1) A4 (2) B4
1464	(1) A4 (2) B4
62-1564	(1) A4 (2) B4
62-1565	(1) A9 (2) B1
1680	(1) AB20
62-2555	(1) A9 (2) B1
62-2557	(1) A9 (2) B1
62-2565	(1) A9 (2) B1
A-2565	(1) A9 (2) B1
62-2566	(1) A6 (2) B4
62-2569	(2) A6 (2) B4
62-2663	(2) A1 (2) B1
A-2663	(2) A1 (2) B1
62-2663	(1) A1 (2) B1
62-2668	(1) A1 (2) B1
A-2668	(2) A1 (2) B1
62-2672	(2) A1 (2) B1
2680	(1) AB20
62-5019	(1) A9 (2) B1
ALLIED RADIO CORP., (see *"Knight"*)	
ANDREA	
G61	(2) A1 (2) B2
6G-61	(2) A1 (2) B2
6G-61A	(2) A1 (2) B2
G63	(2) A1 (2) B2
6G-63	(2) A1 (2) B2
6G-63A	(2) A1 (2) B2
21F5	(1) A9 (2) B2
21AF5	(1) A9 (2) B2
ARCADIA	
4B5	(1) A9 (2) B2
5B3	(1) A9 (2) B2
ARIA	
4B5	(1) A9 (2) B2
5B3	(1) A9 (2) B2
0-551	(1) A6 (2) B1
ARLINGTON	
4B5	(1) A9 (2) B2
5B3	(1) A9 (2) B2
ARVIN	
802	(1) A10 (2) 2
803	(1) A10 (2) 2
820	(1) A10 (2) 4
822	(1) A10 (2) 2
AUTOCRAT	
90	(1) A3 (2) B2
98	(1) A3 (2) B2
105	(1) A15 (2) B8
120	(1) A11 (2) B1
131	(1) A6 (2) B1
132	(1) A6 (2) B1
161	(1) AB21
531	(1) AB5
533	(1) AB5
AUTOMATIC	
P30	(2) A18 (2) B2
P33	(2) A18 (2) B2
P40	(1) A12 (2) B2
P41	(1) A12 (2) B2
P43	(1) A3 (2) B2
P45	(1) A3 (2) B2
P50	(1) A12 (2) B2
P51	(1) A12 (2) B2
P57	(1) A6 (2) B2
P58	(1) A6 (2) B2
P61	(1) A6 (2) B2
P72	(1) A6 (2) B2
P80	(1) A12 (2) B2
P81	(1) A12 (2) B2
"Tom Thumb"	(1) A18 (1) B2
BELMONT	
R141	(1) A3 (2) B4
403	(1) A9 (2) B2
407	(1) A4 (2) B4
411	(1) AB23
418	(1) AB23

—(Cont'd)

Receiver Make & Model No.	Battery Quantities and "Key Designation" Numbers (to be referred to charts on page 556)
BELMONT—*(Cont'd)*	
460	(1) A9 (2) B1
507	(1) A6 (2) B2
511	(1) AB23
	(1) A6 (2) B2
603	(1) AB23
513	or (1) A15 (2) B8
551	(1) A6 (2) B4
62-566	(1) A6 (2) B4
590	(1) A5 (2) B4
BLACK HAWK	
4B5	(1) A9 (2) B2
5B3	(1) A9 (2) B2
CARRYETTE (see *"Westinghouse"*)	
CARRYOLA (see *"Garod"*)	
CHEVROLET (see *"Colonial Radio Corp."*)	
CLARION	
0-464	(1) A10 (2) B2
532	(1) AB5
0-534	(1) A6 (2) B2
0-535	(1) A6 (2) B2
536	(1) AB5
0-539	(1) A6 (2) B2
CLARK	
457	(1) A3 (2) B2
948	(1) A9 (2) B2
949	(1) A9 (2) B2
CLIMAX	
73	(1) A3 (2) B4
507	(1) A6 (2) B2
507L	(1) A6 (2) B1
509	(1) A6 (2) B2
512	(1) A6 (2) B2
561	(1) A7 (2) B2
568	(1) A7 (2) B2
575	(1) A7 (2) B1
578	(1) A6 (2) B1
578B	(1) A6 (2) B2
592	(1) A6 (2) B1
611	(2) A1 (2) B2
COLONIAL	
563	(1) A9 (2) B2
575	(1) A9 (2) B2
620	(1) A12 (2) B2
621	(2) A1 (2) B2
621A	(2) A1 (2) B2
622	(2) A1 (2) B2
623	(1) A12 (2) B2
("Chevrolet")	
985514	(1) A9 (2) B2
985775	(1) A18 (1) B5
CONTINENTAL (see *"Admiral"*)	
CORONADO	
4B5	(1) A9 (2) B2
5B3	(1) A9 (2) B2
6B7	(2) A1 (2) B1
6B10	(2) A1 (2) B1
0556	(1) A11 (2) B2
568	(1) A7 (2) B2
568(I-F 456kc)	(1) A3 (2) B2
590	(1) A6 (2) B4
C590	(1) A6 (2) B4
3006	(2) A1 (2) B1
4002	(2) A1 (2) B1
4946	(2) A1 (2) B1
"Coronado"	(1) A11 (2) B1
CROSLEY	
27	(1) A11 (2) B1
27BD	(1) A12 (2) B2
27BE	(1) A12 (2) B2
45BD	(1) A18 (1) B5
45BV	(1) A18 (1) B5
52PA	(1) AB11
67	(1) A11
429	(1) A9 (2) B1

(Cont'd on next page)

Receiver Make & Model No.	Battery Quantities and "Key Designation" Numbers (to be referred to charts on page 556)

CROSLEY—*(Cont'd)*

B 429A	(1) A9	(2) B2
439	(1) AB15	
B 439A	(1) AB15	
449	(1) A15	(2) B8
458	(1) A15	(2) B8
B 458A	(1) A15	(2) B8
459	(1) AB23	
B 468A	(1) A15	(2) B8
B 548A	(1) A15	(2) B8
549	"Special Batteries"	
B 549A	(1) AB2	
B 549B	(1) AB2	
B 558A	(1) A15	(2) B8
589A	(1) A11	(2) B1
B5549A	(1) A11	(2) B1
B5589M	(1) A15	(2) B8
6579A	(1) AB23	

DELCO

RC527E	(1) A7	(2) B2
RC562	(2) A1	(2) B2
R1400	(1) A9	(2) B2
R1401	(1) A4	(2) B4
R1402	(1) A4	(2) B4
1405	(1) A7	(2) B2
R1406	(1) A7	(2) B2
R1407	(2) A1	(2) B2

DETROLA

282 ("Pee Wee")	(1) A3	(2) B4
286	(1) A9	(2) B2
287	(1) A9	(2) B1
288	(1) A9	(2) B2
289	(1) A3	(2) B2
295	(1) A3	(2) B2
299	(1) A7	(2) B2
299B	(1) A7	(2) B1
303	(1) AB15	
303A	(1) AB15	
339	(2) A1	(2) B2
339-1	(2) A1	(2) B2
340	(2) A1	(2) B2
340-1	(2) A1	(2) B2
341	(2) A1	(2) B2
341-1	(2) A1	(2) B2
341-2	(2) A1	(2) B2
360	(2) A1	(2) B2
360-1	(2) A1	(2) B2
372	(2) A18	(1) B5
378	(2) A18	(1) B5
3401	(2) A1	(2) B2
3412	(2) A1	(2) B2
3601	(2) A1	(2) B2
3602	(2) A1	(2) B2
3603	(2) A1	(2) B2
"Treasure Chest"	(1) AB15	

DE WALD

F5	(1) A3	(2) B2
XF5	(1) A3	(2) B2
G6	(1) A3	(2) B2
XG6	(1) A3	(2) B2
408	(1) A3	(2) B2
408R ("Tourist")	(1) A9	(2) B2
409	(1) A9	(2) B2
410	(2) A18	(1) B5
415 ("Cub")	(1) AB10	
415R	(1) A7	(2) B2
415RA	(1) A7	(2) B2
544	(1) A11	(2) B2
544L	(1) A11	(2) B2
544LW	(1) A11	(2) B2
544P	(1) A11	(2) B2
545	(1) A12	(2) B2
545B	(1) A12	(2) B2
545L	(1) A12	(2) B2
545LW	(1) A12	(2) B2
545P	(1) A12	(2) B2
545SW	(1) A12	(2) B2
564	(2) A18	(1) B5
565	(1) A12	(2) B2

ELEC. RESEARCH LABORATORIES
(see *"Sentinel"*)

EMERSON

AC-DC	(1) AB23	
CX28	(1) AB23	
AJ130	(2) A16	(2) B1
AJ137	(2) A16	(2) B1
AJ149	(2) A16	(2) B1
CE259	(1) A3	(2) B1
CE260	(1) AB23	

—(Cont'd)

Receiver Make & Model No.	Battery Quantities and "Key Designation" Numbers (to be referred to charts on page 556)

EMERSON—*(Cont'd)*

CE263	(1) A9	(2) B1
CX263	(1) A9	(2) B1
DH264	(1) A9	(2) B1
CE265	(1) A9	(2) B1
CE275	(1) A9	(2) B1
CT275	(1) A9	(2) B1
CX275	(1) A9	(2) B1
CX283	(1) A9	(2) B1
CX284	(1) A9	(2) B1
CX285	(1) AB23	
CX292	(1) A9	(2) B1
DF302	(2) A1	(2) B1
CX305	(1) A9	(2) B1
DF306	(2) A1	(2) B1
CX308	(1) A9	(2) B1
DC308	(1) A9	(2) B1
DJ310	(2) A1	(2) B2
DJ311	(2) A1	(2) B2
DJ312	(2) A1	(2) B2
EA312	(2) A1	(2) B2
EA338	(2) A1	(2) B2
EA339	(2) A1	(2) B2
EA340	(2) A1	(2) B2
EE340	(2) A1	(2) B2
EA341	(2) A1	(2) B2
EA1-341	(2) A1	(2) B2
EE344	(2) A1	(2) B2
EA357	(2) A1	(2) B2
EB359	(2) A1	(2) B2
EA363	(2) A1	(2) B2
EF363	(2) A1	(2) B2
DU379	(2) A18	(1) B5
EA379	(2) A19	(1) B5
DU380	(2) A18	(1) B5
EA380	(2) A19	(1) B5
EA385	(2) A1	(2) B2
EA389	(2) A1	(2) B2
EA390	(2) A1	(2) B2
EE390	(2) A1	(2) B2
EE401	(2) A1	(2) B2
402	(2) A1	(2) B2
FF411	(2) A18	(1) B5
424	(2) A1	(2) B2
FU424	(2) A1	(2) B2
426	(1) AB25*	
427	(2) A1	(2) B2
FU427	(2) A1	(2) B2
428	(2) A1	(2) B2
FU428	(2) A1	(2) B2
FR432	(1) A18	(1) B5
433	(1) AB25*	
GC448	(1) A18	(1) B5

ENDURANCE

282	(1) A3	(2) B4

ERLA (see *"Sentinel"*)

ESPEY

BE	(1) AB10	
040	(1) A9	(2) B2
050	(1) A11	(2) B2
052	(1) A60	(2) B2
053	(1) A12	(2) B2
070	(1) A12	(2) B2
942	AB17	
942A	AB17	
942C	AB17	
942F	AB17	
942P	AB17	
943	AB10	
958	AB10	
964	AB10	
965	AB10	

FADA

P22	(1) A12	(2) B2
PD22	(1) A12	(2) B2
PL22	(1) A12	(2) B2
SPL22	(1) A12	(2) B2
P23	(1) A10	(2) B2
PL23	(1) A10	(2) B2
SPL23	(1) A10	(2) B2
P24	(1) A9	(2) B2
PL24	(1) A9	(2) B2
SPL24	(1) A9	(2) B2
P28	(1) A12	(2) B2
PD28	(1) A12	(2) B2
B33	(3) A18	(1) B5
C33	(3) A18	(1) B5
L33	(3) A18	(1) B5
M33	(3) A18	(1) B5
C34	(3) A18	(1) B5
L34	(3) A18	(1) B5
S34	(3) A18	(1) B5
P40	(1) A9	(2) B2
PD40	(1) A9	(2) B2
PL40	(1) A9	(2) B2

—(Cont'd)

*Emerson 749 AB Pack also O.K.

Receiver Make & Model No.	Battery Quantities and "Key Designation" Numbers (to be referred to charts on page 556)

FADA—*(Cont'd)*

P41	(2) A1	(2) B2
PD41	(2) A1	(2) B2
PL41	(2) A1	(2) B2
P47	(1) A3	(2) B2
PD47	(1) A3	(2) B2
P48	(1) A3	(2) B2
P49	(1) A3	(2) B2
P49LW	(1) A9	(2) B2
P49SW	(1) A3	(2) B2
PD49	(1) A3	(2) B2
PD49SW	(1) A3	(2) B2
P58	(1) A9	(2) B2
PL58	(1) A9	(2) B2
144	(1) AB23	
145	(1) AB23	

FARNSWORTH

AT30	(1) A10	(2) B2
AT31	(1) A11	(2) B1
AT40	(1) AB23	
BT40	(1) AB23	
BT41	(1) AB23	
BC45	(1) AB23	
BT57	(1) AB23	
BT58	(1) A3	(2) B2
CT59	(2) A18	(1) B5
CT60	(1) A10	(2) B4
BT68	(1) A3	(2) B2

FEARNOLA

4B5	(1) A9	(2) B2
5B3	(1) A9	(2) B2

FIDELTONE

4B5	(1) A9	(2) B2
5B3	(1) A9	(2) B2

FIRESTONE

XL31	(1) AB10	
500	(1) A16	(2) B2
501	(1) A16	(2) B2
502	(1) A10	(2) B2
504	(1) A6	(2) B2
S-7397-2	(2) A1	(2) B1
S-7402-6	(1) AB12	
S-7426-6	(1) AB10	
S-7426-7	(1) AB10	
S-7426-9	(1) AB10	
S-7427-5	(1) AB12	
Roamer 1-4V	(1) AB10	
Roamer 6-V	(1) AB10	

FREED EISEMAN

P57	(1) A6	(2) B2
P58	(1) A6	(2) B2
P61	(1) A6	(2) B2
P72	(1) A6	(2) B2

GALVIN (see *"Motorola"*)

GAMBLE-SKOGMO (see *"Coronado"*)

GAMBLE STORES (see *"Coronado"*)

GAROD

BP 4	(1) A7	(2) B2
BP 5	(1) A7	(2) B2
BP 5A	(1) A7	(2) B2
BP 6	(1) AB10	
BP 7	(1) A7	(2) B2
BP 8	(1) A7	(2) B2
BP 9	(1) A6	(2) B4
BP 10	(1) A6	(2) B4
BP 11	(2) A1	(2) B2
EB 11	(2) A1	(2) B2
BP 12	(1) A5	(2) B2
BP 12A	(1) A5	(2) B2
BP 12B	(1) A5	(2) B2
BP 12Q	(2) A1	(2) B2
BP 15	(2) A1	(2) B2
BP 20	(3) A18	(1) B5
BP 24	(2) A1	(2) B2
BP 25	(2) A1	(2) B2
BP 27	(1) A1 + (1) A4	(2) B2
BP 28	(1) A1 + (1) A4	(2) B2
BP 29	(1) A1 + (1) A4	(2) B2

(Cont'd on next page)

Receiver Make & Model No.	Battery Quantities and "Key Designation" Numbers (to be referred to charts on page 556)
GAROD—*(Cont'd)*	
BP 36	(2) A1 (2) B2
BP 36A	(2) A1 (2) B2
BP 37	(2) A1 (2) B3
BP 38	(2) A1 (2) B3
B 118	(1) A11 (2) B1
BP118	(1) A11 (2) B1
BP307	(2) A1 (2) B2
BP308	(2) A1 (2) B2
BP309	(2) A1 (2) B2
GENERAL (see *"Climax"*)	
GENERAL ELECTRIC	
GB400	(1) A9 (2) B2
HB401	(1) A9 (2) B1
GB402	(1) AB18
HB402	(1) A3 (2) B4
HB403	(1) A3 (2) B4
BS408	(1) A9 (2) B1
HB408	(1) A9 (2) B2
RHBS408	(1) A9 (2) B1
HB410	(1) A10 (2) B2
JB410	(2) A18 (1) B5
HB411	(1) A10 (2) B2
HB412	(1) A12 (2) B2
GB440	(1) A7 (2) B2
RGBS440	(1) A7 (2) B1
HBX467	(1) A3 (2) B4
HB504	(1) A11 (2) B2
HB505	(1) A11 (2) B2
JB508	(1) A12 (2) B2
JB513	(1) A12 (2) B2
JB514	(1) A12 (2) B2
JB523	(1) A12 (2) B2
JB630	(2) A1 (2) B2
LB700	(2) A1 (2) B2
LB701	(2) A1 (2) B2
LB702	(2) A1 (2) B2
LB703	(2) A1 (2) B2
GENERAL TELEVISION (see *"Climax"*)	
GILFILAN	
AB	(1) A3 (2) B1
4B	(1) A3 (2) B2
4C	(1) A3 (2) B2
5B	(1) A9 (2) B2
6B	(1) A3 (2) B2
GLORITONE	
33FS	(1) A7 (2) B1
33G5	(1) A7 (2) B1
B3466	(1) A7 (2) B1
GOODRICH (see *"Mantola"*)	
GOODYEAR SERVICE (see *"Wings"*)	
GREBE (see *"Garod"*)	
GRIFFITH	
4B5	(1) A9 (2) B2
5B3	(1) A9 (2) B2
HOWARD	
4B	(1) AB23
4BT	(1) AB23
	or (1) A15 (2) B8
10B	(1) A9 (2) B2
10BT	(1) A3 (2) B1
11B	(1) A10 (2) B2
14ACB	(2) A10 (2) B2
HUDSON	
4B5	(1) A9 (2) B2
5B3	(1) A9 (2) B2
KADETTE	
L34	(1) A12 (2) B2
L46	(2) A1 (2) B2
KARADIO	
905	(4) A18 (2) B2
KARNS-WHITE CORP., (see *"Soundview-Marine"*)	

—(Cont'd)

Receiver Make & Model No.	Battery Quantities and "Key Designation" Numbers (to be referred to charts on page 556)
KNIGHT	
5N	(1) A5 (2) B1
5NL	(1) A5 (2) B1
XL28	(1) AB10
PL29	(1) AB10
171AS	(1) A3 (2) B1
178BL	(1) A3 (2) B1
E1095	(1) A3 (2) B1
N2812 (early)	(1) AB6
N2812 (recent)	(1) A11 (2) B1
N2870	(1) AB16
N2871	(1) AB16
E10061	(1) AB10
	or (1) A9 (2) B1
B10505	(3) A18 (1) B4
B10506	(3) A18 (1) B4
B10521	(1) A6 (2) B4
B10522	(1) A6 (2) B4
B10523	(1) A6 (2) B4
B10524	(1) A6 (2) B4
B10540	(1) AB9
B10545	(1) AB9
B10562	(2) A1 (2) B2
B10563	(2) A1 (2) B2
B10564	(2) A1 (2) B2
B10565	(2) A1 (2) B2
B10595	(1) A9 (2) B4
B10600	(3) A18 (1) B4
B10606	(3) A18 (1) B4
A10700	(1) A3 (2) B2 or (1) AB9
A10701	(1) A3 (2) B2 or (1) AB9
E10715	(1) AB10
E10716	(1) AB10
A10725	(1) A3 (2) B2 or (1) AB9
A10730	(3) A18 (1) B4
10748	(1) A6 (2) B1
A10748	(1) A12 (2) B2
E10755	(1) AB16
E10756	(1) AB16
E10757 (early)	(1) AB6
E10757 (recent)	(1) A11 (2) B1
E10758	(1) A9 (2) B1
10761	(1) A10 (2) B2
A10761	(1) A10 (2) B2
E10775	(1) A7 (2) B2
E10777	(1) A9 (2) B2
10795	(1) A11 (2) B1
A10795	(1) A11 (2) B1
A10826	(1) AB10
A10848	(1) A7 (2) B1
A10849	(1) A7 (2) B1
A10855	(1) A5 (2) B2
A10872	(1) A9 (2) B2
A10873	(1) A11 (2) B1
A10889	(1) A9 (2) B1
E10912	(1) AB23
E10916	(1) AB23
E10925	(1) AB15
B17107	(3) A18 (1) B4
B17108	(3) A18 (1) B4
B17109	(1) A9 (2) B4
B17111	(1) A12 (2) B2
B17112	(1) A12 (2) B2
B17115	(1) A9 (2) B4
B17131	(3) A18 (1) B4
B17132	(3) A18 (1) B4
B17133	(3) A18 (1) B4
B17134	(3) A18 (1) B4
LAFAYETTE	
E6	(1) A9 (2) B2
BP12	(1) A5 (2) B1
BP15	(2) A1 (2) B2
BS33	(1) A6 (2) B2
BS33A	(1) A6 (2) B2
BP37	(2) A1 (2) B2
BP38	(2) A1 (2) B2
S50	(1) A7 (2) B2
CC55	(1) A3 (2) B2
CC55A	(1) A3 (2) B2
CC55B	(2) A1 (2) B4
BS56	(1) A9 (2) B2
T56	(1) A5 (2) B2
CC58	(2) A1 (2) B4
CC58A	(2) A1 (2) B4
BB70	(1) A9 (2) B2
BS70	(1) A9 (2) B2
BS72	(1) A3 (2) B1
CC72	(1) A5 (2) B2
E72	(1) A9 (2) B2
BB73	(2) A1 (2) B2
E80	(1) A11 (2) B2
BS85	(1) A9 (2) B2
E92	(1) A10 (2) B2
D93	(1) A6 (2) B2
E94	(1) A11 (2) B2

—(Cont'd)

Receiver Make & Model No.	Battery Quantities and "Key Designation" Numbers (to be referred to charts on page 556)
LAFAYETTE—*(Cont'd)*	
C116	(2) A1 (2) B2
C121	(2) A1 (2) B2
C125	(2) A1 (2) B2
S161	(2) A18 (1) B5
E191	(2) A18 (1) B5
550	(1) A7 (2) B2
20145	(1) A3 (2) B1
20161	(1) AB10
20162	(1) A11 (2) B1
20163	(2) A1 (2) B3
20165	(1) AB23
20168	(1) A6 (2) B3
20169	(1) A7 (2) B1
20170	(1) A6 (2) B1
20171	(1) A6 (2) B1
20172	(1) A7 (2) B1
"Rover"	(1) A7 (2) B2
LA FRANCE	
4B5	(1) A9 (2) B2
5B3	(1) A9 (2) B2
5B3-3904	(1) A9 (2) B1
6B7-3	(2) A1 (2) B1
LAUREL	
4B5	(2) A9 (2) B2
5B3	(2) A9 (2) B2
LEARADIO	
APR1	(1) A17 (1) B7
APRA	(1) A5 (2) B4
LIBERTYPHONE (see *"Espey"*)	
LINCOLN	
P12C	(1) A10 (2) B2
PX12C	(1) A11 (2) B2
P18O	(1) A10 (2) B2
PX21C	(1) A11 (2) B2
L'TATRO	
519	(1) AB23
819	(1) A3 (2) B2
1000	(1) A3 (2) B4
S1000	(10) A18 none
McKESSON ROBBINS (see *"St. Regis"*)	
MACY	
4B5	(1) A9 (2) B2
5B3	(2) A9 (2) B2
BP 7	(1) A3 (2) B1
BP 9	(1) A6 (2) B3
BP10	(1) A6 (2) B3
BP11	(2) A1 (2) B2
BP12	(1) A5 (2) B2
"Supremacy"	(1) A9 (2) B2
MAGNAVOX	
10	(1) A4 (2) B1
41	(1) A3 (2) B2
CR133	(1) A3 (2) B1
PBR378	(1) A3 (2) B1
MAJESTIC	
4C10	(1) AB23
5BD	(1) A4 (2) B4
5ULBD	(1) A4 (2) B4
13OU	(1) A7 (2) B2
1BR50B	(1) A6 (2) B2
1BR50P	(1) A6 (2) B1
1BR50PB	(1) A6 (2) B2
130OM	Special Packs
130U	(1) A7 (2) B1
410	(11) AB23
419B	(11) AB23
420	(1) A3 (2) B1
420PL	(1) A3 (2) B2
421	(1) A3 (2) B2
430PL	(1) A3 (2) B1
431	(1) A3 (2) B1
546BD	(1) A4 (2) B4
MANTOLA	
	(1) A7 (2) B2
R419	(1) A7 (2) B2
R419B	(1) A7 (2) B2
460	(1) AB9

(Cont'd on next page)

Receiver Make & Model No.	Battery Quantities and "Key Designation" Numbers (to be referred to charts on page 556)
MEISSNER	
10-1187	(1) A3 (2) B1
10-1189	(2) A1 (2) B3
10-1190	(2) A1 (2) B3
12-1031	(2) A1 (2) B3
MIDWEST	
P5	(1) A6 (2) B2
MISSION BELL	
400	(1) A3 (2) B2
500	(1) A16 (2) B2
501	(1) A16 (2) B2
502	(1) A10 (2) B2
503	(1) A3 (2) B2
504	(1) A6 (2) B2
507	(2) A1 (2) B2
508	(5) A18 (1) B5
MONARCH (see *"Sky Chief"*)	
MONROE	
4B5	(1) A9 (2) B2
5B3	(1) A9 (2) B2
MONTGOMERY-WARD (see *"Airline"*)	
MOTOROLA	
A1	(2) A18 (1) B5
3A5	(5) A18 (1) B5
40	(1) A3 (2) B1
40BK	(1) AB23
40BW	(1) AB23
41	(1) A7 (2) B1
41D	(1) A7 (2) B1
41D1	(1) A7 (2) B2
41D2	(1) A7 (2) B2
41H	(1) A7 (2) B2
H47	(1) A3 (2) B1
49BT1	(1) AB23
49BT2	(1) AB23
51D	(1) A7 (2) B1
51D1	(1) A7 (2) B2
51D2	(1) A7 (2) B2
51F	(1) A3 (2) B3
52BK	(1) AB23
52BW	(1) AB23
52D	(1) A7 (2) B1
52D1	(1) A7 (2) B2
57BP	(2) A1 (2) B2
(early) 57BP1	(1) A12 (2) B2
(late) 57BP1	(2) A1 (2) B2
57BP1A	(2) A1 (2) B2
(early) 57BP2	(2) A12 (2) B2
(late) 57BP2	(2) A1 (2) B2
57BP2A	(2) A1 (2) B2
57BP3	(2) A1 (2) B2
57BP4	(2) A1 (2) B1
65BP	(2) A1 (2) B2
65BP1	(2) A1 (2) B2
65BP1A	(2) A1 (2) B2
65BP2	(2) A1 (2) B2
65BP2A	(2) A1 (2) B2
65BP3	(2) A1 (2) B2
65BP3A	(2) A1 (2) B2
65BP4	(2) A1 (2) B2
65BP4A	(2) A1 (2) B2
B150	(1) AB7
411	(1) A3 (2) B1
"Aircraft"	(1) A11 (2) B2
MUSIC AIRO	
590-1A	(1) A11 (2) B1
NAMCO	
D110	(1) A12 (2) B2
D111	(1) A12 (2) B2
D112	(1) A12 (2) B2
NOBLITT-SPARKS (see *"Arvin"*)	
PACKARD BELL	
40	(1) A3 (2) B2
40A	(1) A6 (2) B1
40B	(1) A6 (2) B2
41	(1) AB15

—(Cont'd)

Receiver Make & Model No.	Battery Quantities and "Key Designation" Numbers (to be referred to charts on page 556)
PACKARD BELL—*(Cont'd)*	
54	(1) Burgess "AB" Pack
56	(1) A10 (2) B2
56A	(1) Burgess "AB" Pack
57	(1) A10 (2) B2
57A	(1) Burgess "AB" Pack
PHILCO	
39-71T	(1) A3 (2) B2
39-72	(1) A3 (2) B1
39-72T	(1) A3 (2) B2
39-73	(1) A3 (2) B1
39-73T	(1) A3 (2) B2
39-74T	(1) A3 (2) B2
39-504T	(1) A3 (2) B2
40-PT-63	(1) AB15
40-74	(1) A3 (2) B1
40-74T	(1) A3 (2) B2
40-81T	(1) AB15
40-82T	(1) AB15
40-83T	(1) AB15
40-84T	(1) AB24
40-88	(1) AB9
40-88T	(1) AB9
40-90	(1) AB23
40-95	(1) AB23
40-100	(1) AB23
40-105	(1) AB23
40-110	(1) AB23
40-504	(1) A3 (2) B1
40-504T	(1) A3 (2) B2
41PT63	(1) AB15
41-81	(1) AB14
41-81T	(1) AB14
41-83	(1) AB14
41-83T	(1) AB14
41-84	(1) AB5
41-84T	(1) AB5
41-85	(1) AB5
41-85T	(1) AB5
41PT87	(1) AB25
41PT88	(1) AB26
41PT89C	(1) AB26
41-841	(1) AB4
41-842T	(2) A1 (2) B2
41-843T	(2) A1 (2) B2
41-844T	(2) A1 (2) B2
41-851	(1) AB4
41-853T	(2) A1 (2) B2
41-854T	(2) A1 (2) B2
PIERCE AIRO (see *"De Wald"*)	
PILOT	
11	(2) A3 (2) B1
H11	(1) A9 (2) B1
TH11	(1) A3 (2) B2
MTH11	(1) A3 (2) B1
12	(2) A3 (2) B1
H12	(1) A9 (2) B1
TH12	(1) A3 (2) B2
MTH12	(1) A3 (2) B1
B71	(1) A12 (2) B2
T71	(1) A12 (2) B2
T186	(2) A1 (2) B2
T187	(2) A1 (2) B2
1021	(1) A3 (2) B1
T1021	(1) A10 (2) B2
T1351	(1) A12 (2) B2
AM1351	(1) A12 (2) B2
X1351	(1) A12 (2) B2
X1450	(1) A12 (2) B2
T1451	(1) A10 (2) B2
X1451	(1) A12 (2) B2
WX1451	(1) A12 (2) B2
T1452	(1) A10 (2) B2
X1452	(1) A12 (2) B2
WX1452	(1) A12 (2) B2
T1453	(1) A10 (2) B4
X1453	(1) A12 (2) B2
PLYMOUTH	
4B5	(1) A9 (2) B2
5B3	(1) A9 (2) B2
5B5	(1) A7 (2) B1
PORT-O-MATIC	
U17A	(1) A3 (2) B2
U17C	(1) A3 (2) B2
USW17	(1) A3 (2) B1
USW17A	(1) A3 (2) B2
USW17C	(1) A3 (2) B2

—(Cont'd)

Receiver Make & Model No.	Battery Quantities and "Key Designation" Numbers (to be referred to charts on page 556)
PORT-O-MATIC—*(Cont'd)*	
BE27	(1) A9 (2) B1
BE27R	(1) A9 (2) B2
BE27SC	(1) A9 (2) B2
R. C. A.	
4QB	(1) AB23
4QB4	(1) AB23
P5	(1) A7 (2) B2
BP10	(1) A18 (1) B5
15BP	(1) A7 (2) B2
15BP1	(1) A7 (2) B2
15BP2	(1) A7 (2) B2
15BP3	(1) A7 (2) B2
15BP4	(1) A7 (2) B2
15BP5	(1) A7 (2) B2
15BP6	(1) A7 (2) B2
15BP7	(1) A7 (2) B2
25BP	(1) A7 (2) B2
26BP	(2) A1 (2) B2
BT40	(1) AB23
BK41	(1) AB23
BT41	(1) AB23
BT42	(1) AB23
BP55	(1) A12 (2) B2
BP56	(1) A12 (2) B2
BP85	(1) A12 (2) B2
94BK1	(1) A15 (2) B8
94BK2	(1) A15 (2) B8
94BP1	(1) A3 (2) B2
94BP4	(1) A3 (2) B2
94BP61	(1) A3 (2) B2
94BP62	(1) A3 (2) B2
94BP64	(1) A3 (2) B2
94BP66	(1) A3 (2) B2
94BP80	(1) A3 (2) B2
94BP81	(1) A3 (2) B2
94BPL	(1) A3 (2) B1
94BT1	(1) A3 (2) B1
94BT2	(1) A15 (2) B8
96GA	(1) A3 (2) B1
96TA	(1) A3 (2) B1
96T4	(1) A3 (2) B1
AVR102	(2) A1 (2) B2
RC407	(1) A3 (2) B1
RC410	(1) A3 (2) B1
RC455	(1) A12 (2) B4
RC465	(1) A7 (2) B2
RC527	(1) A7 (2) B2
RC527A	(1) A7 (2) B2
RADIETTE	
5B3	(1) A9 (2) B2
4B5	(1) A9 (2) B2
RADIO PRODUCTS (see *"Admiral"*)	
RADOLEK	
17679	(1) A3 (2) B1
17680	(1) A3 (2) B1
17681	(4) A18 (2) B1
REMLER	
92	(1) A3 (2) B1
93	(1) AB10
94	(1) AB10
95	(1) AB10
440	(4) A18 (1) B5
SEARS ROEBUCK (see *"Silvertone"*)	
SENTINEL	
118B	(1) AB23
118BCT	(1) AB23
118BT	(1) AB23
127B	(1) AB23
127BL	(1) A3 (2) B1
127BT	(1) AB23
151BL	(1) A9 (2) B2
160BL	(1) AB16
170BL	(1) AB16
172	(1) A10 (2) B2
172BLSW	(1) A10 (2) B2
178BL	(1) A7 (2) B2
180XL (early)	(1) AB6
180XL (recent)	(1) A11 (2) B2
181BL	(1) A7 (2) B1
RC181BL	(1) A7 (2) B1
181BLCB	(1) A7 (2) B2
192XL	(1) A12 (2) B2
201XL	(1) A11 (2) B1
202	(1) A10 (2) B2

(Cont'd on next page)

Receiver Make & Model No.	Battery Quantities and "Key Designation" Numbers (to be referred to charts on page 556)

SENTINEL—*(Cont'd)*

202BL	(1) A10	(2) B2
202BLLW	(1) A10	(2) B2
205	(1) A10	(2) B2
205BL	(1) A10	(2) B2
213P	(1) A12	(2) B2
217P	(2) A1	(2) B2
219P	(2) A1	(2) B2
222BLW	(1) A10	(2) B2
227-P	(2) A18	(1) B5
228P	(2) A1	(2) B2
231P	(2) A1	(2) B2
247P	(2) A18	(1) B5
262P	(2) A1	(2) B2

SETCHELL-CARLSON

23	(2) A16	(2) B1
55	(4) A18	(2) B2
66	(10) A18 Vibrator	

SILVERTONE

2451	(1) AB23	
6256	(1) A3	(2) B2
6266	(1) A3	(2) B2
6273	(1) A3	(2) B2
6274	(1) A3	(2) B2
6372	(1) A3	(2) B1
6541	(1) A3	(2) B1
6551	(1) A12	(2) B2
6561	(2) A1	(2) B2
6651	(1) A7	(2) B1
6661	(2) A1	(2) B2
6721	(2) A1	(2) B1
6751	(1) A12	(2) B2
6761	(2) A1	(2) B2
6821	(1) A6	(2) B2
6851	(1) A6	(2) B2
6861	(1) A6	(2) B2
6911	(1) A11	(2) B2
6951	(1) A11	(2) B2
7077	(1) A11	(2) ???
7083	(2) A1	(2) B1
7085	(2) A1	(2) B1
7087	(2) A1	(2) B1
7089	(2) A1	(2) B1
7100	2 V. Storage	(2) B8
7104	2 V. Storage	(2) B8
7106	2 V. Storage	(2) B8
7108	2 V. Storage	(2) B8
7110	2 V. Storage	(2) B8
7112	???	(2) B8
7114	2 V. Storage	(2) B8
7158	2 V. Storage	(2) B8
7814	(1) A6	(2) B1

SKY CHIEF

22	(2) A18	(1) B4
B23	(1) A4	(1) B2
D202	(1) A9	(2) B2
212	(1) A3	(2) B2
A212	(1) A3	(2) B1
213	(1) A3	(2) B2
A213	(1) A3	(2) B1
214	(1) A3	(2) B2
215	(1) A3	(2) B2
216	(1) A3	(2) B2
217	(1) A6	(2) B1
218	(1) A3	(2) B2
219	(1) A6	(2) B1
221	(1) A6	(2) B1
222	(1) A4	(2) B1
225	(1) AB10	
226	(1) A6	(2) B2
227	(1) AB10	
229	(1) A6	(2) B1
234	(2) A18	(1) B5
235	(2) A18	(1) B5

SKY HAWK

3910	(1) A9	(2) B2

SONORA

SL26	(1) AB23	
TL26	(1) AB23	
XL28	(1) AB10	
PL29	(1) AB10	
X29	(1) A3	(2) B1

—(*Cont'd*)

Receiver Make & Model No.	Battery Quantities and "Key Designation" Numbers (to be referred to charts on page 556)

SONORA—*(Cont'd)*

XL29	"Special Pack"	
PL37	(1) AB10	
TH46	(1) AB23	
KB73	(1) A12	(2) B2
KB75	(1) A11	(2) B1
KD75	(1) A12	(2) B2
KG80 (Candid)	(3) A18	(1) B4
XL128	(1) A3	(2) B1
XL129	(1) A3	(2) B1
KG132	(3) A18	(1) B4
LR147	(1) A12	(2) B2
400	(6) A18	(2) B2
805	(6) A18	(2) B1

SOUND VIEW MARINE

400	(4) A18	(2) B1
510	(4) A18	(2) B1
805	(6) A18	(2) B1

SPARKS-WITHINGTON (see *"Sparton"*)

SPARTON

401-1	(1) A9	(2) B1
410-1	(1) A9	(2) B1
411-1	(1) A9	(2) B1
549-1	(1) A3	(2) B1
560-M1	(1) A15	(2) B8
571-1	(1) A9	(2) B2
571-M	(1) A9	(2) B2
590-1	(1) A11	(2) B2
590-1C	(1) A11	(2) B1
591-1	(1) A6	(2) B2

SPIEGEL (see *"Air Castle"*)

STEWART-WARNER

02-4A1 To 02-4A9	(1) A7	(2) B2
02-41 To 02-411	(1) A3	(2) B1
02-411 To 02-419	(1) A3	(2) B2
02-421	(1) AB23	
02-427	(1) AB23	
02-428	(1) AB23	
05-5L1 To 05-5L9	(1) A10	(2) B2
05-5X	(1) A7	(2) B2
5X1	(1) A7	(2) B2
15-5X1	(1) A12	(2) B2
15-5Y	(1) A10	(2) B2
15-5Y1	(1) A10	(2) B2
15-5X1	(1) A12	(2) B2

ST. REGIS

263	(1) A9	(2) B2
403	(2) A1	(2) B2

STROMBERG-CARLSON

402H	(1) A9	(2) B2
P30990	(1) A9	(2) B2

SUPREMACY

4B5	(1) A9	(2) B2
5B3	(1) A9	(2) B2
BP 7	(1) A3	(2) B1
BP 9	(1) A6	(2) B3
	or (1) A12	(2) B2
BP10	(1) A6	(2) B3
	or (1) A12	(2) B2

SYMPHONY

4B5	(1) A9	(2) B2
5B3	(1) A9	(2) B2

TELEX

P5	(1) A12	(2) B2
P6	(1) A12	(2) B2

TEMPOTONE

93	(1) AB10	

Receiver Make & Model No.	Battery Quantities and "Key Designation" Numbers (to be referred to charts on page 556)

TRANSITONE (see *"Philco"*)

TRAVELMATE (see *"Packard Bell"*)

TRAV-LER

B70	(1) A6	(2) B4
B71	(1) A12	(2) B2
FB73	(1) A12	(2) B2
B75	(1) A3	(2) B2
B80	(1) A12	(2) B2
B81	(1) A12	(2) B2
B82	(1) A11	(2) B1
FB82	(1) A12	(2) B2
FB83	(1) A12	(2) B2
B86	(1) A12	(2) B2
404	(1) A12	(2) B2
551B	(1) AB23	
552B	(1) AB23	
553	(1) A3	(2) B1
553B	(1) A3	(2) B2
553BT	(1) A3	(2) B1
554	(1) A3	(2) B1
554B	(1) A3	(2) B2
554BT	(1) A3	(2) B1
555	(1) A3	(2) B1
555B	(1) A3	(2) B2
555BT	(1) A3	(2) B1
556	(1) A6	(2) B1
556B	(1) A11	(2) B2
556BT	(1) A11	(2) B1
585B	(1) A3	(2) B2
585BT	(1) A3	(2) B1
B712	(1) A12	(2) B2
1555	(1) A3	(2) B1
1555B	(1) A3	(2) B2
1555BT	(1) A3	(2) B1
1556	(1) A6	(2) B1
1556B	(1) A11	(2) B2
1556BT	(1) A11	(2) B1
1566B	(1) A11	(2) B2
1566BT	(1) A11	(2) B1

TRIANGLE (see *"Western Auto"*)

TROUBADOUR (see *"Warwick"*)

TRUETONE (see *"Western Auto"*)

TROY

4AUP	(1) A6	(2) B2
6AUP	(2) A1	(2) B2
BP140	(1) AB10	
BP550	(1) A10	(2) B2
BP554	(1) A9	(2) B1
BP640	(1) A16	(2) B2
940	(1) A7	(2) B2
949	(1) A7	(2) B2
950	(1) A13	(2) B2
BP950	(1) A12	(2) B2
951	(1) A6	(2) B1
952	(1) A3	(2) B1
953	(1) A6	(2) B1

WARWICK

"AC-DC"	(1) A6	(2) B1
	or (2) A11	(2) B1
40	(1) A3	(2) B1
0-407	(1) A3	(2) B2
0-411	(1) A3	(2) B2
0-425	(1) AB23	
0-435	(1) AB23	
9-437	(1) A7	(2) B1
0-445	(1) AB23	
9-457	(1) A7	(2) B2
0-461	(1) A10	(2) B2
0-464	(1) A10	(2) B2
0-501	(1) A11	(2) B2
0-530	(1) A6	(2) B2
0-531	(1) A6	(2) B2
1-531	(1) AB5	
532	(1) AB5	
0-532	(1) A6	(2) B2
0-533	(1) A11	(2) B2
1-533	(1) AB5	
0-534	(1) A6	(2) B1
0-535	(1) A6	(2) B1
536	(1) AB5	
9-537	(1) AB23	
0-539	(1) A6	(2) B1
1-541	(1) AB5	
1-543	(1) AB5	
0-556	(1) A6	(2) B1
0-557	(1) A6	(2) B1
0-558	(1) A11	(2) B2

(Cont'd on next page)

Receiver Make & Model No.	Battery Quantities and "Key Designation" Numbers (to be referred to charts on page 556)
WATTERSON	
"PB"	(1) A3 (2) B2
415	(1) AB10
945	(1) A3 (2) B1
WELLCO	
4B5	(1) A9 (2) B2
5B3	(1) A9 (2) B2
WELLS-GARDNER	
B3	(1) A9 (2) B1
B4	(1) A7 (2) B1
B8	(1) A9 (2) B1
4B5	(1) A9 (2) B2
4B5-3	(1) A9 (2) B2
4B5-4	(1) A9 (2) B2
4B11	(1) A4 (2) B4
4B19	(1) AB26
5B3	(1) A9 (2) B2
5B4	(1) A15 (2) B8
5B8	(1) A9 (2) B2
5B9	(1) A9 (2) B1
5B12	(1) A6 (2) B4
5B20	(1) AB26
6B7	(2) A1 (2) B2
6B7-3	(2) A1 (2) B2
6B7-4	(2) A1 (2) B2
6B10	(2) A1 (2) B2
6B16	(2) A1 (2) B1
6B18	(2) A1 (2) B1
WESTERN AIR PATROL	
4B5	(1) A9 (2) B2
5B3	(1) A9 (2) B2
WESTERN AUTO	
4B5	(1) A9 (2) B1
5B3	(1) A9 (2) B1
D937	(1) A9 (2) B2
—(*Cont'd*)	

Receiver Make & Model No.	Battery Quantities and "Key Designation" Numbers (to be referred to charts on page 556)
WESTERN AUTO—(*Cont'd*)	
D938	(1) A9 (2) B2
D939	(1) A3 (2) B4
D940	(1) A5 (2) B2
D1080	(1) A6 (2) B4
D1182	(1) A6 (2) B4
WESTINGHOUSE	
WR166	(1) A3 (2) B1
RC410A	(1) A3 (2) B1
RC433	(1) A9 (2) B1
RC455A	(1) A12 (2) B2
WR674	(1) A3 (2) B2
WR675	(1) A9 (2) B2
WR675A	(1) A9 (2) B2
WR676	(1) A12 (2) B2
678	(2) A1 (2) B2
WR678	(1) A12 (2) B2
679	(2) A1 (2) B2
WR679	(1) A12 (2) B2
WR680	(2) A1 (2) B2
WR682	(1) A18 (1) B5
WILCOX-GAY	
A58	(1) A7 (2) B8
A73	(1) A12 (2) B2
WINDSOR	
4B5	(1) A9 (2) B2
5B3	(1) A9 (2) B2
WINGS	
4B5	(1) A7 (2) B1
5B3	(1) A7 (2) B1
WOR	
4B5	(1) A9 (2) B2
5B3	(1) A9 (2) B2
—(*Cont'd*)	

Receiver Make & Model No.	Battery Quantities and "Key Designation" Numbers (to be referred to charts on page 556)
ZENITH	
4K400	(1) A3 (2) B2
4K400D	(1) A3 (2) B2
4K400L	(1) A3 (2) B2
4K400M	(1) A3 (2) B2
4K400S	(1) A3 (2) B2
4K400Y	(1) A3 (2) B2
5G401	(1) AB3
5G401D	(1) AB3
5G401L	(1) AB3
5G401M	(1) AB3
5G401Y	(1) AB3
4K402	(1) AB8
4K402D	(1) AB8
4K402F	(1) AB8
4K402L	(1) AB8
4K402M	(1) AB8
4K402Y	(1) AB8
4K600	(1) A18 (1) B5
5G403	(1) AB3
5G405	(1) AB3
5G484M	(1) AB3
5G500	(1) AB11
5G500FR	(1) AB13
5G500L	(1) AB11
5G500LR	(1) AB13
5G500M	(1) AB11
5G500R	(1) AB13
5G500MR	(1) AB13
5G501	(1) AB11
6G501F	(1) AB13
6G501L	(1) AB13
6G501M	(1) AB13
5G504	(1) AB11
6G505	(1) AB13
5416	(1) A3 (2) B1
7G605	(2) A18 (1) AB13
ZEPHYR	
34J5	(1) AB9
578	(1) A12 (2) B2
583	(1) A12 (2) B2
585	(1) A12 (2) B2
592	(1) A6 (2) B1

See "Keyed" Chart of Batteries on next page.

"KEYED" CHART OF ELECTRICALLY COMPARABLE "A" & "B" BATTERIES, AND "AB" PACKS, FOR PORTABLE RADIO RECEIVERS

"A" Battery Key Designations →	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19
ACME	123	———	114	123M	———	———	116	———	118	118FM	118S	118S6	114S	———	———	———	———	———	———
ADVANCE	647	———	247	———	———	2476	147	———	147	547	817	747	———	———	———	———	———	———	———
AIR CASTLE	———	———	———	———	———	———	———	———	———	———	———	———	———	———	2320	———	———	———	———
BOND	4928	———	4826	———	———	———	4824	———	4829	4823	4827	4825	———	———	4828	1611 or ※6	———	102	———
BRIGHT STAR	361	461	462	465	561	646	660	661	860	865	866	868	———	———	20-60	6A	———	10M	———
BURGESS	G3	———	4F	4FL	G5	F4PI	6F	———	8F	8FL	2F4	2F4L	F4PIX	———	20F	4FA	2F	2 Uni-cell	———
CROSLEY	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———
EVEREADY	746	———	742	———	———	———	743	———	741*	745	718	747	———	———	740	7111 or ※6	———	950	———
FIRESTONE	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———
GAMBLE	———	———	———	———	———	———	1966	———	———	———	———	———	———	———	———	———	———	———	———
GENERAL	3H3	———	4F1	3L1	5H5	4F4	6F1	———	8F1	8CF1	8F4	8CF4	———	———	12L1L	※6	2F1	D	4H1
MARATHON	———	———	491	3L	———	———	691	———	891	———	———	———	———	———	189	———	———	———	———
MONTGOMERY WARD	5042	———	5021	5022	———	5008	5005	———	5020	———	5006	———	———	———	5016	———	———	———	———
NATIONAL UNION	A835	———	A830	———	———	———	A831	———	A833	———	A834	———	———	———	A832	※6	———	D	———
PHILCO	P-100	———	P94	———	———	———	———	———	P8F1	———	———	———	———	———	———	———	———	D	———
RAY-O-VAC	P83A	———	P94A	P94L	P85A	P694A	P96A	———	P98A	P98L	P698A	P698L	———	P24SA	P9203	※6	———	2LP	———
SEARS ROEBUCK (old)	———	———	5063	———	———	———	———	———	———	———	———	———	———	———	5062	———	———	———	———
SEARS ROEBUCK (new)	5085	———	5089	5077	———	———	5087	———	———	5077	5086	5078	———	———	5160	———	———	———	———
USALITE	683	———	634	642	687	639	637	———	635	645	638	646	636	———	———	※6	———	75	———
WESTERN	———	———	D234	———	———	D216	D236	———	———	———	———	———	———	———	———	———	———	———	———
WILLARD	3H3	———	4F1	3L1	5H5	4F4	6F1	———	8F1	8CF1	8F4	8CF4	———	———	———	———	———	D	———
WINCHESTER	4918	———	4816	———	———	———	4814	———	4819	4813	4817	4815	———	———	4818	※6	———	1511	———
ZENITH	———	———	Z10	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———

**Discontinued for the Duration. Replaceable by Eveready 743 (which is one size smaller)*

'B" Battery Key Designations →	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13
ACME	330	830	———	430	———	(Two)530	———	———	———	———	———	———	———
ADVANCE	267	284	———	237	———	———	———	———	———	———	———	———	———
AIR CASTLE	———	———	———	———	———	———	———	———	———	———	———	———	———
BOND	3017	6220	———	———	———	———	———	3044	———	4044	———	———	———
BRIGHT STAR	30-03	30-33	30-50	30-55	———	———	———	30-95	———	———	———	———	———
BURGESS	B30	M30	A30M	Z30	XX45	A60	Z59	2308 or 22308	A30X	2308	W30PI	XX30	———
CROSLEY	———	———	———	———	———	———	———	———	———	———	———	———	———
EVEREADY	762	482	———	738	467	———	———	485	727*	585	733	———	———
FIRESTONE	———	———	———	———	———	———	———	———	———	———	———	———	———
GAMBLE	5130	———	———	———	———	———	———	2130	———	1203	———	———	———
GENERAL	V30B	W30B	———	V30AA	W45A	———	———	V30D1	F30A	V30D	V30AAA	———	41AAA
MARATHON	350	———	———	340	———	———	———	3020	———	230	———	———	———
MONTGOMERY WARD	4-949	4952	———	4951	———	———	———	5777	———	5804	———	———	———
NATIONAL UNION	B860	B861**	———	———	———	———	———	B850	———	———	———	———	———
PHILCO	P305	P200	———	———	———	———	———	———	———	P30D	———	———	———
RAY-O-VAC	P5303	P5S30	———	P7R30	P4367	BB60P-IMP	———	P2303	BB30P	P5233	P3A30	———	———
SEARS ROEBUCK (old)	———	———	———	———	———	———	———	———	———	———	———	———	———
SEARS ROEBUCK (new)	5090	5079	———	———	———	———	———	5150	———	5093	———	———	———
USALITE	624	640	622	621	———	———	———	———	———	632	———	———	———
WESTERN	D213	———	———	D214	———	———	———	———	———	D212	———	———	———
WILLARD	V30B	W30B	———	V30A	———	(Two)V30AA	———	V30DL	———	V30D	———	———	———
WINCHESTER	6218	6210	———	———	———	———	———	6518	———	6568	———	———	———
ZENITH	———	———	———	———	———	———	———	———	———	———	———	———	———

**Note:* This battery now Discontinued ***Discontinued for the Duration. Replaceable by National Union B862*

For explanation of this Chart see text on Page 549

Although all the comparative types formerly available are listed here, the manufacture of most types has been discontinued for the duration due to lack of strategic materials and manufacturing facilities.

"AB" Battery Pack Key Designations →	AB1	AB2	AB3	AB4	AB5	AB6	AB7	AB8	AB9	AB10	AB11	AB12	AB13	AB14	AB15	AB16	AB17	AB18	AB19	AB20	AB21	AB22	AB23	AB24	AB25	AB26
ACME	———	———	360-4FS	———	———	———	———	860-41	460-15S	460-15	———	———	———	———	442-2	———	460-15MS	———	———	———	———	460-14S	———	———	———	———
ADVANCE	———	———	———	———	———	———	———	———	———	411	———	———	———	———	41AD7	———	———	837	———	———	———	659	———	———	———	———
AIR CASTLE	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———
BOND	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	0528	———	———	———
BRIGHT STAR	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	61-05	———	———	———
BURGESS	D4A60	F4A41	F4B60	F5A60	2F4A60	2F4B60	3FA60	4FA60	6FA60	5DA60	G4B50	G4B60	G6B60	4GA41	4GA42	4TA60	5DA60	———	———	———	———	———	17GD60	———	G5A42	———
CROSLEY	———	649	———	———	———	———	———	———	———	———	———	———	———	———	49	———	———	———	———	———	———	———	———	———	———	———
EVEREADY	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	748	———	———	———
FIRESTONE	———	———	———	———	———	———	———	———	———	E15275	———	E15276	———	———	———	———	———	———	———	———	———	———	———	———	———	———
GAMBLE	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———
GENERAL	———	———	———	———	60A4F4 or 60A4FL4	———	60A4F1	P60A4L	60A4L	60A2L	Z50B4H4	60B4H	———	———	41A4FL	———	———	60A4H	———	60B6H6	———	———	60DL-11L	60A110	———	———
MARATHON	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———
MONTGOMERY WARD	———	———	———	———	———	———	———	———	5001	5003	5045	———	———	———	5004	———	———	———	———	———	———	———	5047	———	———	———
NATIONAL UNION	———	———	———	———	———	———	———	———	N803	———	———	———	———	———	N802	———	———	———	———	———	———	———	N-801	———	———	———
PHILCO	———	———	———	P841	P60A8F4	———	———	———	P60A4L	———	———	———	———	P41A4G	P41A4FL	———	———	———	———	———	———	———	P60D11L	P60A110	P87	P89
RAY-O-VAC	———	AB648	———	———	AB694	———	MB49	———	AB84	———	———	———	———	———	AB419	———	———	———	———	———	AB94	———	AB82	———	AB794	———
SEARS ROEBUCK (old)	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———
SEARS ROEBUCK (new)	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	10793	———	———	———	———	———	———	5170	———	———	———
USALITE	AB664	———	———	———	AB674	———	AB675	———	AB667	AB665	AB670	———	AB677	AB672	AB669	———	———	———	AB668	———	———	———	AB666	AB671	AB676	———
WESTERN	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	D-235	———	———	———
WILLARD	———	———	———	———	———	———	———	———	———	60A2L	———	———	———	———	P41A4FL	———	———	60A4H	———	———	———	———	60DL11L	———	———	———
WINCHESTER	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	———	0518	———	———	———
ZENITH	———	———	Z659	———	———	———	———	Z9B	———	———	Z675	———	Z985	———	———	———	———	———	———	———	———	———	Z802	———	———	———

— 15 —

CHART OF "PHYSICAL DIMENSIONS" & "ELECTRICAL SPECIFICATIONS" OF 12 LEADING MAKES OF "A," "B" AND "A-B" DRY BATTERIES & PACKS FOR "PORTABLE" & "FARM" RADIO RECEIVERS

Checking Physical Dimensions of Replacement Batteries for Portable Receivers

In this chart, those portable radio set batteries (of various makes) which are closely similar, or are considered generally interchangeable, have been grouped together in each case, and their exact dimensions (length, width and height) in inches, terminal arrangements, etc., are listed so they may be easily checked and compared.

Whenever it is desired to order the batteries of a different manufacturer for replacement purposes (even though they may be listed on the chart of page 556 as being comparable) it is well to first check their dimensions from this chart, for it will be found that the batteries of one manufacturer are often as much as ½" larger in one or more of the dimensions than the corresponding comparable batteries of another manufacturer. By first checking the dimensions of the batteries you intend to use, you can make sure they will fit into the space available without harmful jamming or squeezing. Of course, judgment should be exercised when using this chart.

Other Useful Data Contained in this Chart

In addition to supplying the dimensions of the various batteries, this chart supplies valuable information concerning the voltages, type and number of terminals provided, standard-package quantities and weights, and general information concerning the recommended types of service, for all the popular makes and types of radio "A", "B" and "AB pack" dry batteries manufactured for use in portable radio receivers, and listed in the Battery Replacement Charts on pages 549 to 555 of this *Handbook*.

The author acknowledges with thanks, the cooperation of the Engineering Departments of the various battery manufacturers in supplying the miscellaneous engineering data from this chart has been carefully compiled.

CHART STARTS ON NEXT PAGE

Although all the types formerly available are listed here, the manufacture of most units has been discontinued for the duration due to lack of strategic materials and manufacturing facilities.

CHART OF PHYSICAL DIMENSIONS & ELECTRICAL SPECIFICATIONS OF 12 LEADING MAKES OF DRY "A", "B" and "A-B" BATTERIES AND PACKS FOR "PORTABLE" & "FARM" RADIO RECEIVERS

Make	Battery Catalog Number	*Voltage*	*Type*	*Terminals*	*Dimensions in Inches*	*Std. Pkg. Quantity*	*Std. Pkg. Wt. Lbs. (Total)*
			"A" BATTERIES FOR PORTABLE RECEIVERS				
Bond	102	1½ V. "A"	Flashlight Cell	Flashlight	1¼ Dia. x 2¼	480	114
Bright Star	10M	"	"	"	1⅜ Dia. x 2⅜	480	110
Burgess	2 Unicell	"	"	"	1 5/16 Dia. x 2 5/16	50	11
Eveready	950	"	"	"	1-21/64 Dia. x 2-27/64	384	85
General	D	"	"	"	1¼ Dia. x 2⅜	250	60
Philco	D	"	"	"	1¼ Dia. x 2⅜	240	58
Ray-O-Vac	2LP	"	"	"	1 5/16 Dia. x 2⅜	480	112
Usalite	75	"	"	"	1¼ Dia. x 2¼	240	55
Winchester	1511	"	"	"	1¼ Dia. x 2¼	48	—
Ray-O-Vac	P24SA	1½ V. "A"	Portable "A"	2-prong Socket	2 9/16 x 2 9/16 x 3	6	6
Bright Star	461	1½ V. "A"	Portable "A"	2-prong Socket	3 13/16 x 2 9/16 x 2⅞	1	1½
Burgess	2F	1½ V. "A"	Portable "A"	2-prong Socket	2⅝ x 1⅜ x 4 3/16	6	4½
General	2F1	"	"	"	2½ x 2 x 4	10	8
Acme	114	1½ V. "A"	Portable "A"	2-prong Socket	2½ x 2½ x 4	6	8½
Bond	4826	"	"	"	2 9/16 x 2 9/16 x 4	10	15
Bright Star	462	"	"	"	2 9/16 x 2 9/16 x 4	1	1½
Burgess	4F	"	"	"	2⅝ x 2⅝ x 4 1/16	10	14
Eveready	742	"	"	"	2 17/32 x 2 17/32 x 4	1	1¾
General	4F1	"	"	"	2½ x 2½ x 4	10	16
Philco	P94	"	"	"	2½ x 2½ x 4½	1	2
National Union	A830	"	"	"	2⅝ x 2⅝ x 4	6	8
Ray-O-Vac	P94A	"	"	"	2⅝ x 2⅝ x 4	6	8
Usalite	634	"	"	"	2 9/16 x 2 9/16 x 4	48	66
Willard	4F1R	"	"	"	2½ x 2½ x 4	10	16
Winchester	4816	"	"	"	2 9/16 x 2 9/16 x 4	10	15
General	4H1	1½ V. "A"	Portable "A"	2-prong Socket	2½ x 2½ x 4½	10	19
Willard	4H1	"	"	"	2½ x 2½ x 4½	10	19
Acme	116	1½ V. "A"	Portable "A"	2-prong Socket	3¾ x 2½ x 4	6	12
Bond	4824	"	"	"	3¾ x 2 9/16 x 4	6	13
Bright Star	660	"	"	"	3 13/16 x 2 9/16 x 4⅛	1	2
Burgess	6F	"	"	"	3 15/16 x 2¾ x 4½	6	13½
Eveready	743	"	"	"	3¾ x 2 9/16 x 3 31/32	1	2¼
General	6F1	"	"	"	3⅞ x 2½ x 4	5	12
National Union	A831	"	"	"	3⅞ x 2⅝ x 4	4	8
Ray-O-Vac	P96A	"	"	"	3⅞ x 2⅝ x 4	4	8
Usalite	637	"	"	"	3 3/16 x 2 9/16 x 3⅞	12	24
Willard	6F1	"	"	"	3⅞ x 2½ x 4	5	12
Winchester	4814	"	"	"	3¾ x 2 9/16 x 4	6	13
Willard	3L1	1½ V. "A"	Portable "A"	2-prong Socket	3⅞ x 2½ x 4	5	12
Acme	123M	1½ V. "A"	Portable "A"	2-prong Socket	3⅞ x 1¼ x 4 9/16	6	9
Bright Star	465	"	"	"	3 13/16 x 1⅜ x 5⅝	1	1½
Burgess	4FL	"	"	"	3⅞ x 1 5/16 x 5½	6	5
General	3L1	"	"	"	3⅞ x 1 5/16 x 6 5/16	10	21
Ray-O-Vac	P94L	"	"	"	3 13/16 x 1 7/16 x 5 11/16	6	8
Usalite	642	"	"	"	3¾ x 1⅜ x 5 11/16	48	66
			Heavy-Duty				
Acme	118	1½ V. "A"	Portable "A"	2-prong Socket	3 13/16 x 2⅝ x 5½	6	14½
Bond	4829	"	"	"	3 11/16 x 2 9/16 x 5 5/16	6	18
Bright Star	860	"	"	"	3 13/16 x 2⅝ x 5⅜	1	2¾
Burgess	8F	"	"	"	3 13/16 x 2⅝ x 5 7/16	6	17
Eveready	741*	"	"	"	3 13/16 x 2 31/32 x 5 11/32	1	3¼
General	8F1	"	"	"	3⅞ x 2¾ x 5⅜	5	16
National Union	A833	"	"	"	3¾ x 2⅝ x 5 5/16	6	16½
Philco	P8F1	"	"	"	3⅞ x 2¾ x 5⅜	5	16
Ray-O-Vac	P98A	"	"	"	—	—	—
Usalite	635	"	"	"	3¾ x 2 11/16 x 5⅜	25	68¾
Willard	8F1	"	"	"	3⅞ x 2¾ x 5⅜	5	16
Winchester	4819	"	"	"	3 11/16 x 2 9/16 x 5 5/16	6	18
Bond	1611 or #6	1½ V. "A"	Heavy-Duty "A"	Screw	2½ Dia. x 6	1	2
Bright Star	6A	"	"	Clip or Screw	2½ Dia. x 6	25	57
Burgess	4FA	"	"	Screw	2⅝ Dia. x 4 5/16	20	29

**Discontinued for the Duration Replaceable by Eveready 743 (which is one size smaller)*

(Cont'd)

Make	Battery Catalog Number	Voltage	Type	Terminals	Dimensions in Inches	Std. Pkg. Quantity	Std. Pkg. Wt. Lbs. (Total)
—(*Cont'd*)							
Eveready	7111 or #6	1½ V. "A"	Heavy-Duty "A"	Screw	2⅝ Dia. x 6⅝	12	27
General	#6	"	"	Screw	2 9/16 Dia. x 6⅛	25	60
Ray-O-Vac	#6	"	"	Screw	2⅝ Dia. x 6	25	58½
Usalite	#6	"	"	Clip or Screw	2 Dia. x 6	25	55
Winchester	#6	"	"	Screw	2½ Dia. x 6	25	58
General	4L1	1½ V. "A"	Portable "A"	2-prong Socket	2½ x 2½ x 6⅜	6	17
Willard	4L1	"	"	"	2½ x 2½ x 6⅜	6	17
Acme	118FM	1½ V. "A"	Heavy-Duty "A"	2-prong Socket	10¾ x 3¾ x 1⅜	6	14½
Bond	4823	"	"	"	10 13/16 x 3 13/16 x 1⅜	6	20
Bright Star	865	"	"	"	10¾ x 3 13/16 x 1⅜	1	2¾
Burgess	8FL	"	"	"	10 11/16 x 3 29/32 x 1 7/16	6	18½
Eveready	745	"	"	"	10¾ x 3 27/32 x 1 3/32	1	3¼
General	8CF1	"	"	"	8½ x 3¾ x 1 1/16	5	10½
Ray-O-Vac	P98L	"	"	"	10¾ x 5⅞ x 1 7/16	6	16
Usalite	645	"	"	"	10¾ x 3 27/32 x 1 3/32	12	33
Winchester	4813	"	"	"	10 13/16 x 3 13/16 x 1⅜	6	20
Acme	123	4½ V. "A"	Small "A"	2-prong Socket	3⅞ x 1¼ x 4 9/16	6	9
Bond	4928	"	"	"	3⅞ x 1 5/16 x 4 11/16	10	13
Bright Star	361	"	"	"	3 29/32 x 1 5/16 x 4 11/16	2	2¾
Burgess	G3	"	"	"	4 x 1⅜ x 4 13/16	6	7½
Eveready	746	"	"	"	3 29/32 x 1 5/16 x 4 11/16	2	2½
General	3H3	"	"	"	3⅞ x 1 5/16 x 4¾	6	9
Philco	P-100	"	"	"	3⅞ x 1 5/16 x 4¾	2	7
Ray-O-Vac	P83A	"	"	"	4 x 1⅜ x 4 11/16	8	9½
Usalite	683	"	"	"	3⅞ x 1⅜ x 4 9/16	12	15
Willard	3H3	"	"	"	3⅞ x 1 5/16 x 4¾	6	9
Winchester	4918	"	"	"	3⅞ x 1 5/16 x 4 11/16	10	13
Bright Star	661	6 V. "A"	Light-Duty "A"	2-prong Socket	3 13/16 x 2⅝ x 2 15/16	1	1½
Bright Star	646	6 V. "A"	Light-Duty "A"	2-prong Socket	2⅝ x 2⅝ x 4 1/16	1	1½
Burgess	F4PI	"	"	"	2⅝ x 2⅝ x 4	6	8½
General	4F4	"	"	"	2½ x 2½ x 4	10	16
Ray-O-Vac	P694A	"	"	"	2⅝ x 2⅝ x 4¼	6	8
Usalite	639	"	"	"	2 9/16 x 2 9/16 x 4	12	18
Willard	4F4R	"	"	"	2½ x 2½ x 4	10	16
Acme	114S	6 V. "A"	Light-Duty "A"	St'd. 6V. Socket	2½ x 2½ x 4½	6	8½
Burgess	F4PIX	"	"	"	2⅝ x 2⅝ x 4	6	8½
Usalite	636	"	"	3-prong Socket	2 9/16 x 2 9/16 x 4	50	87½
Acme	118S	6 V. "A"	Heavy-Duty "A"	2-prong Socket	3 13/16 x 2⅝ x 5½	6	14½
Bond	4827	"	"	"	3¾ x 2 11/16 x 5⅜	10	30
Bright Star	866	"	"	"	3 13/16 x 2⅝ x 5 7/16	1	2¾
Burgess	2F4	"	"	"	3⅞ x 2 11/16 x 5½	6	18
Eveready	718	"	"	"	3 13/16 x 2 31/32 x 5 11/32	1	3¼
General	8F4	"	"	"	3⅞ x 2¾ x 5⅜	5	16
National Union	A834	"	"	"	3 13/16 x 2 11/16 x 5⅜	6	12
Ray-O-Vac	P698A	"	"	"	3⅞ x 2¾ x 5½	6	12
Usalite	638	"	"	"	3¾ x 2 11/16 x 5⅜	12	33
Willard	8F4	"	"	"	3⅞ x 2¾ x 5⅜	5	16
Winchester	4817	"	"	"	3¾ x 2 11/16 x 5⅜	10	30
Acme	118S6	6 V. "A"	Heavy-Duty "A"	2-prong Socket	10¾ x 3¾ x 1⅜	6	14½
Bond	4825	"	"	"	10 13/16 x 3 13/16 x 1⅜	6	20
Bright Star	868	"	"	"	10¾ x 3 13/16 x 1⅜	1	2¾
Burgess	2F4L	"	"	"	10 11/16 x 3 29/32 x 1 7/16	6	18½
Eveready	747	"	"	"	10¾ x 3 27/32 x 1 3/32	1	3¼
General	8CF4	"	"	"	8⅞ x 3¾ x 1 1/16	5	10½
Ray-O-Vac	P698L	"	"	"	10¾ x 3⅞ x 1 7/16	6	16½
Usalite	646	"	"	"	10¾ x 3 27/32 x 1 3/32	12	33
Winchester	4815	"	"	"	10 13/16 x 3 13/16 x 1⅜	6	20
Bright Star	561	7½ V. "A"	Small "A"	2-prong Socket	3⅞ x 2⅝ x 4 9/16	1	2
Burgess	G5	"	"	"	3⅝ x 2 11/16 x 4 5/16	6	12¾
General	5H5	"	"	"	3 9/16 x 2 11/16 x 4⅜	5	11½
Ray-O-Vac	P85A	"	"	"	3⅞ x 2⅝ x 4 9/16	4	8
"A" BATTERY PACKS FOR NON-PORTABLE RECEIVERS							
Bond	4828	1½ V. "A"	Heavy-Duty "A"	2-prong Socket	6 15/16 x 2¾ x 7 13/16	4	30
Bright Star	20-60	"	"	"	7¾ x 2⅞ x 7⅛	1	7
Burgess	20F	"	"	"	7¼ x 2 11/16 x 7 11/16	4	29½

(Cont'd over)

Make	Battery Catalog Number	Voltage	Type	Terminals	Dimensions in Inches	Std. Pkg. Quantity	Std. Pkg. Wt. Lbs. (Total)
—(Cont'd)							
Eveready	740	1½ V. "A"	Heavy-Duty "A"	"	4 9/16 x 3 7/8 x 7 5/8	1	7
General	12L1L	"	"	"	7 7/8 x 2 3/4 x 6 3/4	4	32½
National Union	A832	"	"	"	7 3/4 x 2 15/16 x 7 1/8	6	43½
Ray-O-Vac	P9203	"	"	"	7 3/4 x 2 15/16 x 7 1/8	6	43½
Winchester	4818	"	"	"	7 13/16 x 2 3/4 x 6 15/16	4	30
			"B" BATTERIES FOR PORTABLE RECEIVERS				
Burgess	W30PI	45 V. "B"	Small "B"	Socket	2 15/16 x 1 3/16 x 3 13/16	6	4
Eveready	733	"	"	"	2 15/16 x 1 5/16 x 4 3/16	5	4
General	V30AAA	"	"	"	2 15/16 x 1¼ x 4⅛	10	8½
Ray-O-Vac	P3A30	"	"	"	3 x 1⅜ x 4	4	6
Burgess	XX30	45 V. "B"	Small "B"	Snap-On	2 9/16 x 15/16 x 3¾	6	2½
Eveready	455	"	"	"	2⅝ x 29/32 x 3⅝	12	6½
Bright Star	30-50	45 V. "B"	Small "B"	Duplex Socket	4 1/16 x 3½ x 2 7/16	2	3½
Burgess	A30M	"	"	"	4⅛ x 3½ x 2 11/16	6	11
Usalite	622	"	"	"	4 1/16 x 3⅜ x 2⅝	24	33
Acme	330	45 V. "B"	Stand. "B"	Duplex Socket	4 1/16 x 2½ x 5⅜	6	16½
Bond	3017	"	"	"	4 1/16 x 2½ x 5¼	6	18
Bright Star	30-03	"	"	"	4⅛ x 2 9/16 x 5⅜	2	5½
Burgess	B30	"	"	"	4 1/16 x 2 9/16 x 5 5/16	6	16
Eveready	762	"	"	"	4 3/16 x 2 17/32 x 5 11/32	2	6
General	V30B	"	"	"	4¼ x 2½ x 5⅜	10	29
National Union	B860	"	"	"	4⅛ x 2 9/16 x 5 5/16	6	16
Philco	P305	"	"	"	4⅛ x 2½ x 5¼	10	29
Ray-O-Vac	P5303	"	"	"	4⅛ x 2 9/16 x 5 5/16	6	16
Usalite	624	"	"	"	4⅛ x 2 9/16 x 5 5/16	24	60
Willard	V30B	"	"	"	4¼ x 2½ x 5⅜	10	29
Winchester	6218	"	"	"	4 1/16 x 2½ x 5¼	6	18
Acme	430	45 V. "B"	Small "B"	Duplex Socket	3½ x 2¼ x 4½	6	9
Bright Star	30-55	"	"	"	3½ x 2¼ x 4⅝	2	3½
Burgess	Z30	"	"	"	3 1/16 x 2¼ x 4	6	8¼
Eveready	738	"	"	"	2 15/16 x 5 5/16 x 4 1/16	1	1½
General	V30AA	"	"	"	3 x 2¼ x 4⅛	10	15
Ray-O-Vac	P7R30	"	"	"	3 x 2⅜ x 4	6	7
Usalite	621	"	"	"	3⅜ x 2¼ x 4½	24	33
Willard	V30A	"	"	"	3⅜ x 2¼ x 4½	10	18½
Acme	830	45 V. "B"	Small "B"	Duplex Socket	3½ x 1 11/16 x 5⅜	6	10½
Bond	6220	"	"	"	3½ x 1¾ x 5 7/16	6	11
Bright Star	30-33	"	"	"	3 9/16 x 1¾ x 5 7/16	2	3½
Burgess	M30	"	"	"	3 9/16 x 1⅞ x 5⅝	12	20
Eveready	482	"	"	"	3½ x 1¾ x 5 7/16	2	4 lb. 3 oz.
General	W30B	"	"	"	3 9/16 x 1 11/16 x 5⅜	10	22
National Union	B861*	"	"	"	3½ x 1¾ x 5 5/16	6	11
National Union	B862	"	"	"	3 9/16 x 1 13/16 x 5 7/16	6	13
Ray-O-Vac	P5S30	"	"	"	3 9/16 x 1 13/16 x 5½	6	11
Usalite	640	"	"	"	3½ x 1¾ x 5 7/16	24	48
Winchester	6210	"	"	"	3½ x 1¾ x 5 7/16	6	11
Burgess	A30X	45 V. "B"	Small "B"	Socket	4½ x 1½ x 5 13/32	6	11
Eveready	727	"	Discontinued				
General	F30A	"	"	"	4 5/16 x 1½ x 5⅝	10	18½
Philco	P-200	"	"	"	4 5/16 x 1½ x 5⅝	2	7
Ray-O-Vac	BB30P	"	"	"	4 3/16 x 1¾ x 5 5/16	6	10¼
Burgess	XX45	67½ V. "B"	Very Small "B"	Snap Fastener	1⅜ x 2 11/16 x 3 11/16	6	4
Eveready	467	"	"	"	1 5/16 x 2 11/16 x 3⅝	12	10
General	W45A	"	"	"	1⅜ x 2⅝ x 3⅝	6	5½
Ray-O-Vac	P4367	"	"	"	1 5/16 x 2 11/16 x 3 11/16	12	9½
Burgess	Z59	88½ V. "B"	"B"	———	3½ x 2¼ x 5⅞	6	14
Acme	530	(Two) 45 V. "B"	Very Small "B"	Duplex Socket	4½ x 1⅞ x 3	8	10½
Burgess	A60	90 V. "B"	"	"	4½ x 3¼ x 4⅜	4	14
Ray-O-Vac	BB60P-IMP	90 V. "B"	"	Socket	5 x 3 5/16 x 4⅜	3	11
Willard	V30AA	(Two) 45 V. "B"	"	Duplex	3 x 2¼ x 4⅛	10	15

*Discontinued for the Duration. Replaceable by National Union B862 battery.

(Cont'd)

Make	Battery Catalog Number	Voltage	Type	Terminals	Dimensions in Inches	Std. Pkg. Quantity	Wt. Lbs. Std. Pkg. (Total)
"B" BATTERIES FOR NON-PORTABLE RECEIVERS							
Bond	3044	45 V. "B"	Standard "B"	3-prong Socket	7 15/16 x 2 1/8 x 7 1/16	6	48
Bright Star	30-95	"	"	"	7 3/4 x 2 7/8 x 7 1/16	1	7 1/4
Burgess	22308	"	"	3-prong Socket or Spring Clips	7 3/16 x 3 1/16 x 8 1/8	6	57
Eveready	485	"	"	3-prong Socket	8 1/32 x 3 1/8 x 7 3/16	6	57
General	V30DL	"	"	"	8 x 3 1/8 x 7 1/8	6	52
National Union	B850	"	"	"	8 1/8 x 3 1/4 x 7 1/8	6	46
Ray-O-Vac	P2303	"	"	"	8 1/8 x 3 1/4 x 7 1/8	6	46
Willard	V30D1	"	"	"	8 x 3 1/8 x 7 1/8	6	44
Winchester	6518	"	"	"	7 15/16 x 2 1/8 x 7 1/16	6	48
Bond	4044	45 V. "B"	Stand. "B"	3-prong Socket or Clips	7 15/16 x 2 1/2 x 7 1/16	6	47
Burgess	2308	"	"	"	8 x 2 7/8 x 7 1/8	6	45 3/4
Eveready	585	"	"	"	8 1/32 x 3 1/8 x 7 3/16	6	55
General	V30D	"	"	"	8 x 3 1/8 x 7 1/8	6	46
Philco	P30D	"	"	3-prong Socket	8 x 3 x 7	6	46
Ray-O-Vac	P5233	"	"	"	8 1/8 x 3 1/4 x 7 1/8	6	45
Usalite	632	"	"	"	7 1/8 x 2 1/8 x 7	6	42
Willard	V30D	"	"	"	8 x 3 1/8 x 7 1/8	6	46
Winchester	6568	"	"	"	7 15/16 x 3 x 7 3/16	6	47
"A-B" PACKS FOR PORTABLE RECEIVERS							
Philco	P89	1 1/2 V. "A"—58 1/2 V. "B"	"A-B" Pack	Socket	9 x 2 1/2 x 1 3/8	6	10 1/2
Usalite	AB672	1 1/2 V. "A"—61 1/2 V. "B"	"A-B" Pack	Socket	9 7/16 x 3 5/16 x 2 3/16	10	42 1/2
Burgess	4GA41	1 1/2 V. "A"—61 1/2 V. "B"	"A-B" Pack	Socket	9 3/16 x 3 5/16 x 2 11/16	1	4 1/4
Philco	P41A4G	1 1/2 V. "A"—62 1/2 V. "B"	"	"	9 7/16 x 3 3/8 x 2 5/8	6	28
Burgess	4GA42	1 1/2 V. "A"—61 1/2 V. "B"	"A-B" Pack	4-prong Socket	9 x 2 x 4 3/4	1	4 1/2
General	41A4FL	"	"	"	9 3/8 x 1 7/8 x 4 3/4	6	26 1/2
National Union	N802	"	"	"	9 3/8 x 2 x 4 3/4	1	4 1/4
Philco	P41A4FL	1 1/2 V. "A"—60V. "B"	"	"	9 3/8 x 2 x 4 3/4	6	26 1/2
Ray-O-Vac	AB419	1 1/2 V. "A"—61 1/2 V. "B"	"	"	9 1/2 x 2 1/16 x 4 7/8	1	4 1/4
Usalite	AB669	"	"	"	9 3/8 x 2 x 4 3/4	10	40
Willard	----------	"	"	"	9 3/8 x 1 7/8 x 4 3/4	6	26 1/2
Acme	460-15	1 1/2 V. "A"—90V. "B"	"A-B" Pack	4-prong Socket	7 x 5 1/2 x 2 1/4	6	27
Burgess	5DA60	"	"	"	6 7/8 x 5 9/16 x 2 11/16	1	5
General	60A2L	"	"	"	7 x 5 7/16 x 2 3/4	1	5 1/2
Usalite	AB665	"	"	"	6 15/16 x 5 7/16 x 2 3/4	10	40
Willard	60A2L	"	"	"	7 x 5 7/16 x 2 3/4	1	5 1/2
Acme	860-41	1 1/2 V. "A"—90V. "B"	"A-B" Pack	8-prong Socket	7 x 3 1/4 x 4 1/8	6	28 1/2
Burgess	4FA60	"	"	----------	7 x 3 1/2 x 4 3/8	1	5 1/4
Burgess	4TA60	1 1/2 V. "A"—90V. "B"	"A-B" Pack	Socket	8 1/8 x 2 3/8 x 4 3/4	1	4 3/4
Acme	460-15S	1 1/2 V. "A"—90V. "B"	"A-B" Pack	8-prong Socket	9 3/8 x 4 1/2 x 2 1/2	6	28 1/2
Burgess	6FA60	"	"	----------	11 15/16 x 6 1/4 x 1 5/8	1	5 1/2
General	60A4L	"	"	4-prong Socket	12 x 6 3/8 x 1 7/16	6	39 3/4
National Union	N803	"	"	"	12 x 6 5/16 x 1 7/16	6	30
Philco	P60A4L	"	"	"	12 x 6 5/16 x 1 7/16	6	39 3/4
Ray-O-Vac	AB84	"	"	"	11 7/8 x 6 7/16 x 1 1/2	6	30
Usalite	AB667	"	"	"	12 x 6 3/8 x 1 7/16	10	45
Acme	460-15MS	1 1/2 V. "A"—90V. "B"	"A-B" Pack	4-prong Socket	9 3/8 x 2 1/2 x 4 1/2	6	28 1/2
Burgess	6TA60	"	"	"	9 15/16 x 2 1/4 x 4 7/8	1	5 1/4
Burgess	2GA60	1 1/2 V. "A"—90V. "B"	"A-B" Pack	Socket	9 1/2 x 2 1/4 x 4 7/8	1	4 3/4
Burgess	3FA60	1 1/2 V. "A"—90V. "B"	"A-B" Pack	4-prong Socket	10 1/2 x 4 3/8 x 2 3/8	1	4 1/2
Ray-O-Vac	MB49	"	"	"	10 11/16 x 4 1/4 x 2 3/8	6	28 1/2
General	60A4H	1 1/2 V. "A"—90V. "B"	"A-B" Pack	One 2-prong, two 3-prong Sockets	12 1/2 x 2 5/8 x 3 1/2	6	35 1/2
Willard	60A4H	"	"	"	12 1/2 x 2 5/8 x 3 1/2	6	35 1/2
Burgess	F4A41	6V. "A"—61 1/2 V. "B"	"A-B" Pack	4-prong Socket	5 5/16 x 4 7/8 x 2 1/16	1	4
Ray-O-Vac	AB648	"	"	"	9 3/8 x 4 15/16 x 2 1/4	1	4 1/2

(Cont'd over)

Make	Battery Catalog Number	Voltage	Type	Terminals	Dimensions in Inches	Std. Pkg. Quantity	Wt. Lbs. Std. Pkg. Total
—(*Cont'd*)				Special Zenith			
Burgess	G4B50	6V"A"—75V. "B"	"A-B" Pack	Socket	4 1/8 x 12 3/8 x 2 13/16	1	6 1/4
General	Z50B4H4	"	"	"	4 1/4 x 12 5/8 x 2 3/4	1	7
Usalite	AB670	"	"	"	4 x 12 1/2 x 2 3/4	10	55
Zenith	Z675	"	"	"	4 1/4 x 12 5/8 x 2 3/4	—	—
Burgess	D4A60	6V."A"—90V. "B"	"A-B" Pack	4-prong Socket	6 15/16 x 5 1/2 x 2 5/8	1	5
Usalite	AB664	"	"	"	6 15/16 x 5 7/16 x 2 3/4	10	40
Acme	460-14S	6V."A"—90V. "B"	"A-B" Pack	Special 4-prong Socket	5 1/2 x 2 1/4 x 7	6	27
Burgess	2F4B60	6V."A"—90V. "B"	"A-B" Pack	Socket	10 3/16 x 4 1/8 x 4 1/16	1	8 3/4
Acme	360-4FS	6V."A"—90V. "B"	"A-B" Pack	Special Zenith Socket	10 1/16 x 2 1/2 x 4 13/16	1	6 3/4
Burgess	F4B60	"	"	———	10 5/8 x 2 3/4 x 5	1	6 1/2
Burgess	G4B60	6V."A"—90V. "B"	"A-B" Pack	4-prong Socket	10 3/4 x 2 13/16 x 5	1	7
General	60B4H	"	"	Socket	10 7/8 x 2 3/4 x 5	1	8
Usalite	AB673	6V."A"—90V. "B"	"A-B" Pack	3-prong Socket	11 5/16 x 4 1/4 x 2 5/8	10	50
Burgess	2F4A60	6V."A"—90V. "B"	"A-B" Pack	3-prong Socket	11 5/16 x 2 11/16 x 4 1/8	1	6 1/2
General	60A4F4 / 60A4FL4	"	"	"	10 11/16 x 2 9/16 x 4 5/16	6	33 1/2
Philco	P60A8F4	"	"	"	11 7/8 x 2 5/8 x 4 1/4	6	42
Ray-O-Vac	AB694	"	"	"	10 3/4 x 2 13/16 x 4	1	4 3/4
Usalite	AB668	6V."A"—90V. "B"	"A-B" Pack	1 "A" Socket / 2 "B" Sockets	10 5/8 x 2 1/2 x 4 3/16	10	50
General	60A110	6V."A"—90V. "B"	"A-B" Pack	4-prong Socket	12 1/4 x 1 7/16 x 6 3/8	6	39 3/4
Philco	P60A110	"	"	"	12 1/4 x 1 7/16 x 6 7/16	6	39 3/4
Burgess	G5A42	7 1/2V."A"—63V. "B"	"A-B" Pack	4-prong Socket	9 3/32 x 4 3/32 x 2 3/4	1	4 3/4
Emerson	AB749	"	"	"	9 1/4 x 4 x 2 7/8	1	4
Philco	P87	"	"	"	9 1/2 x 4 x 2 5/8	6	30
Ray-O-Vac	AB794	"	"	"	8 5/8 x 4 x 2 5/8	6	26 1/2
Usalite	AB676	7 1/2V. "A"—67 1/2V "B"	"	"	9 3/16 x 4 x 2 5/8	6	—
Burgess	F5A60	7 1/2V."A"—90V. "B"	"A-B" Pack	Socket	11 1/16 x 2 11/16 x 4 1/8	1	5 1/2
Philco	P841	"	"	"	11 7/8 x 2 5/8 x 4 1/4	6	36
Burgess	G6B60	9V."A"—90V. "B"	"A-B" Pack	Socket	13 7/8 x 4 11/16 x 2 13/16	1	8 1/4
Usalite	AB677	"	"	"	13 7/8 x 4 11/16 x 2 3/4	5	42.5
Zenith	Z985	"	"	"	14 x 2 5/8 x 4 3/8	—	—

"A-B" PACKS FOR 1½-VOLT FARM RECEIVERS

Bond	0528	1 1/2V."A"—90V. "B"	"A-B" Farm Pack.	4-prong Socket	15 13/16 x 4 1/16 x 6 15/16	1	22
Bright Star	61-05	"	"	"	15 3/4 x 4 1/4 x 7	1	21 1/4
Burgess	17GD60	"	"	"	15 3/4 x 4 7/16 x 7 1/16	1	22 1/2
Eveready	748	"	"	"	15 3/4 x 4 3/8 x 6 7/8	1	25
General	60D11L	"	"	"	16 x 4 1/2 x 6 5/8	1	25 1/4
Philco	P60D11L	"	"	"	16 x 4 1/2 x 7 1/8	1	23 1/4
Ray-O-Vac	AB82	"	"	"	15 3/4 x 4 1/4 x 7	1	21 1/4
Usalite	AB666	"	"	"	16 x 4 1/2 x 7 1/8	1	23 1/2
Willard	60DL11L	"	"	"	16 x 4 1/2 x 6 3/4	1	24 1/2
Winchester	0518	"	"	"	15 13/16 x 4 1/16 x 6 15/16	1	22

CHART OF GRID-BIAS RESISTOR RESISTANCE VALUES & WATTAGE RATINGS FOR ALL SELF-BIASED TUBES

SERVICEMEN frequently find it necessary to replace faulty grid-bias resistors in receivers which employ "self-biasing" arrangements for obtaining the proper grid-bias voltages for the various tubes. Of course if the manufacturer's schematic circuit diagram (with resistor values) for the receiver is easily available, or, if the faulty bias resistor is color coded—either according to the RMA Standard Color Code for resistors (see *Section 34* in this *Handbook*), or according to some special *known* Color Code used by the manufacturer of the receiver—it is a simple matter for the serviceman to identify its value and replace it with a new resistor of similar value. However, there are many instances when the serviceman has no ready means of identifying the value of a faulty bias resistor—as in the case of "Orphan," "Special Brand," or other receivers employing a special and unfamiliar resistor color code (or none at all), and for which no schematic circuit diagram with resistor values is readily available. In such cases, other means must be resorted to for determining the correct bias resistor value.

As we shall see later, the serviceman may *calculate* the values of replacement grid-bias resistors needed on a service job, but a great deal of valuable time will be saved if a chart giving the correct *resistance* and *wattage* rating of the grid-bias resistor to use for normal-bias operation of each type of tube (under usual circuit and plate and screen voltage operating conditions) is at hand instead for quick reference. Such a chart, giving complete grid-bias resistor data for each and every one of 297 different tube types now manufactured that can be operated with a cathode-bias resistor, has been compiled and presented here for this purpose. Of course, if over-biased operation is employed, higher values of bias resistor than specified here must be used.

Grid-bias resistor data on "combination tubes," such as the 6A7, 6B7, etc., are included in this chart of course. Unless otherwise specified, only the *amplifier* or *detector* portion of such combination tubes is considered, for the *diode* section of a 6B7 tube, for example, has nothing to do with the value of the bias resistor required by the *pentode* section.

By *use* is meant the function of the tube as it is actually being used in the circuit. When a tube may be used for more than one purpose, or under different operating conditions, the correct value of bias resistor for each different purpose and condition is specified in the chart.

Net "Plate Volts" and "Screen Volts" Specified in Chart

It is important to note that "plate volts" and "screen volts"—the *net* voltages actually being applied between *plate* and *cathode,* and *screen* and *cathode,* of the tube—are specified in this chart in preference to the somewhat objectionable practice of specifying the "total B-supply volts." It must be remembered that the net "plate voltage" (voltage actually existing between plate and cathode) is equal to:

Net plate voltage = Total B-Supply voltage — (voltage drop in plate-load resistance + grid bias voltage)

Similarly:

Net screen voltage = Total B-Supply voltage — (voltage drop in screen resistor + grid bias voltage)

It is the *net* voltages (which are, therefore, always *less* than the B-supply voltage) that alone determine the correct value of grid bias to apply to the tube. The reasons, therefore, for compiling this grid-bias resistor chart on the basis of *net* "plate volts" and "screen volts" are:

(1) that it is easier for the serviceman to refer to standard tube data when the *net* "plate volts" and "screen volts" are specified

(2) that since it is the actual *net* "plate volts" and "screen volts" applied to the tube that determine the correct grid bias to apply to it, if one is to determine the correct grid bias and grid-bias resistor to use, he should know the *net* "plate volts" and "screen volts" actually being applied to the tube

In some circuit arrangements, particularly in resistance-coupled amplifier circuits employing high resistances in the plate circuits, the voltage-drop in the plate load may be appreciable, and the actual *net* "plate volts" may be considerably *less* than the "B-supply volts."

In order to make the charted data on the tube operating conditions as complete as possible, where a tube is being operated in a resistance-coupled amplifier circuit, *the value of the d-c plate load in ohms* is specified in the chart.

Determining Correct Bias when Net Plate or Screen Voltages Differ from those Specified in this Chart

It is well, also, to remember two useful mathematical relations for determining the correct grid bias voltage to apply to a tube when the *net* plate or screen voltages being applied to it are of different value than those specified in standard *Tube Data Characteristic Charts* (see *Section 22* of this *Handbook*), or in this *Grid Bias Resistor Chart*. These are:

(1) For Triodes:

First, look up (in this *Grid Bias Resistor Chart*) the bias volts specified for a *net* plate voltage nearest to that actually being applied to the tube. Then,

$$\frac{\text{Desired Bias}}{\text{Specified bias}} = \frac{\text{actual } \textit{net} \text{ plate voltage being applied}}{\text{nearest specified } \textit{net} \text{ plate voltage}}$$

or, Desired Bias =

$$\frac{\text{specified bias} \times \text{actual } \textit{net} \text{ plate voltagge being applied}}{\text{nearest specified net plate voltage}}$$

(2) For Screen-Grid Tubes:

First, look up the bias volts specified for a *net* screen voltage nearest to that actually being applied to the tube. Then,

Desired bias =

$$\frac{\text{specified bias} \times \text{actual } \textit{net} \text{ screen voltage being applied}}{\text{nearest specified } \textit{net} \text{ screen voltage}}$$

Bias-Resistor Value for Tubes in Push-Pull

When two tubes are operated in push-pull and a single common bias resistor is used for both of them, the resistance value of the bias resistor to be employed is usually *half* of that specified in this chart for a *single* tube of the same type and operating at the same plate and bias voltages. This is true unless stated otherwise in the table. The *wattage rating* of the bias resistor employed for the push-pull arrangement should be the nearest commercial size that is approximately *double* that of the bias resistor specified for a single tube.

How to "Calculate" Bias-Resistor Resistance Value

Although the correct self-bias resistor values for all present tubes are tabulated in the chart which follows, it is well for the serviceman to know exactly how to calculate the resistance and wattage ratings of the self-bias resistor required for any tube or tubes under any specified operating conditions so that he will understand how to calculate bias resistor values for all new tubes which are brought out in the future. The grid-bias resistor value for self-bias is given by the following formula:

$$R = \frac{E_g \times 1{,}000}{(I_b + I_c)\, n}$$

where R = the grid-bias resistor value in *ohms*

E_g = the grid-bias required in *volts* (at the plate and screen voltages at which the tube is operating)

I_b = the plate current of the single tube, in *milliamperes*

I_c = the total screen current of the single tube, in *milliamperes*

n = the number of such tubes passing their cathode currents through the grid-bias resistor

For *triodes*, the screen current term, I_c, disappears, and no screen voltage need be considered.

For *tetrodes*, the "screen current" is that of the single screen grid.

For *pentodes*, the "screen current" is the sum of the screen-grid and suppressor grid currents.

For *pentagrid converters* the plate, total screen, and oscillator plate currents must be added to obtain the total cathode current term represented inside the parenthesis in the formula

Example—Let it be desired to determine the value of the single self-bias resistor necessary to obtain the proper value of grid bias for two type 6K7 tubes working in the radio frequency stages of a receiver. First determine (by actual measurement with a high-resistance voltmeter if necessary) the plate and screen voltages being applied to these tubes in the receiver. Suppose, in this case, it is found that the "plate volts" is 250 and the "screen" voltage is 100 volts. Looking in the *Tube Characteristic Chart* in *Section 22* of this book—or in the *Grid Bias Resistor Chart* in this *Section*—it is found that the proper grid bias for the 6K7 tubes under these conditions is —3 volts. The chart also shows that for each tube the plate current is 7.0 milliamperes and the screen current is 1.7 milliamperes. Substituting these values in the foregoing formula, we have

$$R = \frac{3 \times 1{,}000}{(7.0 + 1.7)\,2} = \frac{3{,}000}{17.4} = 172.4 \text{ ohms}$$

Since this is an odd-value resistance, the nearest commercial size to this (probably a 175-ohm resistor) would be used. We shall see presently how the "wattage rating" of the resistor to be used can be calculated.

The required "resistance value" of grid-bias resistors can be calculated in this way for any type and any number of tubes. When making all such calculations be sure to determine first:

(1) the *net* plate voltage at which the tubes are working
(2) the *net* screen voltage (if a *tetrode* or *pentode*)
(3) the correct value of grid bias voltage required at these plate and screen voltages
(4) the plate and screen currents for one tube at the given *net* plate and screen voltage
(5) the number of such tubes passing their cathode currents through the bias resistor.

Remember that the *net* plate voltage alone (not the *total B*-supply voltage) determines the correct value of

grid bias which must be applied to the tube by the grid-bias resistor.

How to Calculate Bias-Resistor "Wattage" Size

After the necessary "resistance" value of the grid-bias resistor has been calculated, attention must be directed to see that the actual resistor selected is of sufficient size and heat dissipating ability (*wattage rating*) to carry the current without excessive temperature rise. The actual *wattage* dissipated in a resistor can easily be calculated from the following formula (which is deduced indirectly from Ohm's law):

$$Watts = \frac{E^2}{R}$$

where E = the voltage drop across the resistor (*volts*)
R = the resistance in *ohms*

Example: Applying this formula for the case of the grid-bias resistor considered in the previous *Example*, we have,

$$W = \frac{3 \times 3}{172.4} = 0.05 \text{ watts}$$

When selecting the actual resistor for a given use, the wattage value given by the foregoing formula should be multiplied by from 2 to 10, depending upon such factors as the amount of air circulation, mounting position and proximity of other heat-producing parts, which will exist when the resistor is mounted in the place provided for it. For a given wattage dissipation, the larger the resistor, the lower will be its operating temperature per unit of surface area (see chart on page 648).

In the foregoing example, therefore, in order to provide a sufficient safety margin, we might multiply the 0.05 watts by the factor of 10. This would give 0.5 watts. A commercial 175-ohm, ½-watt resistor would very likely be satisfactory, therefore, for use as the grid-bias resistor for the two 6K7 tubes considered in the examples.

Cut-Off Bias Voltage

Since servicemen must often replace volume controls which vary the grid bias on one or more tubes in the receiver, they should be familiar with the matter of "cut-off" bias and the formula for calculating it. The "cut-off" is the point where plate current ceases to flow as the grid voltage is made increasingly negative. In grid-bias type volume control circuits, the volume control resistor value should be such that the control range is never extended into the "cut-off" region, otherwise serious distortion will result. For *triode* tubes, the formula for the "cut-off" voltage is:

$$\text{"Cut-off" voltage} = \frac{\text{Plate voltage}}{\text{Mu}}$$

It must be remembered that this simple formula applies to *triode* tubes only. It cannot be used for calculating the "cut-off" bias voltage for tetrodes, pentodes and variable-mu tubes. The *Tube Characteristic Chart* which appears in *Section 22* of this book, and the Grid-Bias Resistor Chart which follows here, give the "cut-off" voltage values for these more complicated types of tubes.

CHART OF GRID-BIAS RESISTOR RESISTANCE VALUES & WATTAGE RATINGS—FOR ALL SELF-BIASED TUBES

Tube Type No.	When Used As	Plate Volts	Grid-Bias Volts (Neg.)	Plate Current (Ma.)	Screen Current (Ma.) / Screen Volts	Grid-Bias Resistor (Ohms)	Grid-Bias Resistor Rating (Watts)	Cut-off Bias (Volts)	Special Operating Condition Notes	Tube Type No.
01A	Amplifier	135	9	3	———	3,000	⅛	——	———	01A
		90	4.5	2.5	———	1,800	⅛	——	———	
	Biased Detector	135	13.5	0.2	———	65,000	⅛	——	———	
		90	7.5	0.2	———	40,000	⅛	——	———	
1A4-P 1A4-T	Amplifier	180	3	2.3	0.8, (67.5 Volts)	1,000	⅛	15	———	1A4-P 1A4-T
		90	3	2.2	0.9, (67.5 Volts)	1,000	⅛	15	———	
1A5G 1A5GT	Power Amplifier	85	4.5	3.5	0.7, (85 Volts)	1,000	⅛	——	———	1A5G 1A5GT
1A6	Pentagrid Converter	180	3	3.6*	2.4, (67.5 Volts)	500	⅛	22.5	*Sum of osc.-plate & output-plate cur.	1A6
		135	3	3.5*	2.5, (67.5 Volts)	500	⅛	22.5		
1A7G 1A7GT	Pentagrid Converter	90	zero	1.75	0.6, (45 Volts)	zero	——	2	———	1A7G 1A7GT
1B4P	Amplifier	180	3	1.7	0.6, (67.5 Volts)	1,300	⅛	6.0	———	1B4P
		90	3	1.6	0.7, (67.5 Volts)	1,300	⅛	6.0	———	
	Biased Detector	180	6	adjust screen volts for cathode current of 0.2 ma		30,000	⅛	——	———	
		135	4.5			22,500	⅛	——	———	
		90	3			15,000	⅛	——	———	
1B5/25S	Amplifier	135	3	0.8	———	3,750	⅛	——	———	1B5/25S
		90	2	0.43	———	4,600	⅛	——	———	
		45	1	0.15	———	6,500	⅛	——	———	
1B7 1B7GT	Pentagrid Converter	90	zero	3.1*	1.3, (45 Volts)	zero	——	14.5	*Sum of osc.-plate & output-plate cur.	1B7 1B7GT
1B8GT	Pentode Power-Amplified Section	90	6	6.3	1.4, (90 Volts)	800	⅛	——	———	1B8GT
		67.5	4.5	4.2	1.2, (67.5 Volts)	850	⅛	——	———	
	Triode Sec. Amplifier	90	zero	———	———	zero	——	——	———	
1C5G 1C5GT	Power Amplifier	90	9	6	1.4, (90 Volts)	1,200	⅛	——	———	1C5G 1C5GT
		83	7	7	1.6, (83 Volts)	800	⅛	——	———	
1C6	Pentagrid Converter	180	3	4.8*	2, (67.5 Volts)	440	⅛	14	*Sum of osc.-plate & output-plate cur.	1C6
		135	3	3.9*	2, (67.5 Volts)	500	⅛	14		

(Cont'd on next page)

Tube Type No.	When Used As	Plate Volts	Grid-Bias Volts (Neg.)	Plate Current (Ma.)	Screen Current (Ma.) / Screen Volts	Grid-Bias Resistor (Ohms)	Grid-Bias Resistor Rating (Watts)	Cut-off Bias (Volts)	Special Operating Condition Notes	Tube Type No.
1C7G	Pentagrid Converter	180	3	4.8*	2, (67.5 Volts)	440	1/8	----	*Sum of osc.-plate & output-plate cur.	1C7G
		135	3	3.9*	2, (67.5 Volts)	500	1/8	----		
1D5GP	Amplifier	180	3	2.3	0.8, (67.5 Volts)	1,000	1/8	15		1D5GP
		90	3	2.2	0.9, (67.5 Volts)	1,000	1/8	15		
1D7G	Pentagrid Converter	180	3	3.6*	2.4, (67.5 Volts)	500	1/8	----	*Sum of osc.-plate & output-plate cur.	1D7G
		135	3	3.5*	2.5, (67.5 Volts)	500	1/8	----		
1D8GT	Pentode Power Amplifier Section	90	9	5	1.0, (90 Volts)	1,500	1/8	----		1D8GT
		67.5	6	3.8	0.8, (67.5 Volts)	1,300	1/8	----		
		45	4.5	1.6	0.3, (45 Volts)	2,400	1/8	----		
	Triode Amplifier Section	90	zero	1.1	----	zero	----	----		
		67.5	zero	0.6	----	zero	----	----		
		45	zero	0.3	----	zero	----	----		
1E5GP	Amplifier	180	3	1.7	0.6, (67.5 Volts)	1,300	1/8	----		1E5GP
		90	3	1.6	0.7, (67.5 Volts)	1,300	1/8	----		
	Biased Detector	180	6	adjust screen volts for cathode current of 0.2 ma.		30,000	1/8	----		
		135	4.5			22,500	1/8	----		
		90	3			15,000	1/8	----		
1E7G	Power Amplifier (Push-Pull)	135	7.5	6.5 (Both Sections)	2, (135 Volts)	900	1/2	----		1E7G
1F4	Power Amplifier	135	4.5	8	2.6, (135 Volts)	425	1/2	----		1F4
		90	3	4	1.3, (90 Volts)	550	1/2	----		
1F5G	Power Amplifier	135	4.5	8	2.6, (135 Volts)	425	1/2	----		1F5G
		90	3	4	1.3, (90 Volts)	550	1/2	----		
1F6	Amplifier	180	1.5	2	0.6, (67.5 Volts)	600	1/8	12		1F6
	Resist. Coupled Amplifier	135*	2	0.42	adjust screen volts for plate current of 0.42 ma.	4,000	1/8	----	*Thru a 0.25 meg. plate load	
		135*	1.5	0.42		3,500	1/8	----		
		135*	1	0.42		2,500	1/8	----		
1F7GV	Amplifier	180	1.5	2	0.6, (67.5 Volts)	580	1/8	----		1F7GV
	Resist. Coupled Amplifier	135	2	0.42	adjust screen volts for plate current of 0.42 ma.	4,000	1/8	----		
		135	1.5	0.42		3,500	1/8	----		
		135	1	0.42		2,500	1/8	----		
1G4G 1G4GT	Amplifier	90	6	2.3	----	2,600	1/8	----		1G4G 1G4GT
1G5G	Power Amplifier	135	13.5	9.7	3.6, (135 Volts)	1,000	1/2	----		1G5G
		124	11	10.7	4.3, (124 Volts)	750	1/2	----		
		90	6	8.7	3.0, (90 Volts)	500	1/2	----		
1G6G 1G6GT	Amplifier	90	zero	1.0	----	zero	----	----		1G6G 1G6GT
1H4G	Amplifier	180	13.5	3.1	----	4,350	1/8	----		1H4G
		135	9	3	----	3,000	1/8	----		
		90	4.5	2.5	----	1,800	1/8	----		
	Power Amplifier (2 tubes)	157.5	15	29 (2 tubes)	----	500	1	----		
	Biased Detector	180	18	0.2	----	90,000	1/8	----		
		135	13.5	0.2	----	67,500	1/8	----		
		90	9	0.2	----	45,000	1/8	----		
1H5G 1H5GT	Amplifier	90	zero	0.15	----	zero	----	----		1H5G 1H5GT
1H6G	Amplifier	135	3	0.8	----	3,750	1/8	----		1H6G
		90	2	0.43	----	4,600	1/8	----		
		45	1	0.15	----	6,500	1/8	----		
1J5G	Power Amplifier	135	16.5	7	2, (135 Volts)	1,800	1/2	----		1J5G
1J6G	Power Amplifier	135	6	25	----	250	1/2	----		1J6G
		135	3	25	----	125	1/2	----		
1LA4	Power Amplifier	90	4.5	4.0	0.8, (90 Volts)	950	1/8	----		1LA4
1LB4	Power Amplifier	90	9	5.0	1.0, (90 Volts)	1,500	1/8	----		1LB4
1LB6	Pentagrid Converter	90	zero	0.4	2.2, (67.5 Volts)	zero	----	----		1LB6
1LC5	Amplifier	90	zero	1.15	0.2, (45 Volts)	zero	----	----		1LC5
		45	zero	1.1	0.25, (45 Volts)	zero	----	----		
1LC6	Pentagrid Converter	45	zero	2.1*	0.75, (35 Volts)	zero	----	3	*Sum of osc.-plate & output-plate cur.	1LC6
1LD5	Amplifier	90	zero	0.6	0.1, (45 Volts)	zero	----	----		1LD5
		45	zero	0.55	0.12, (45 Volts)	zero	----	----		
		81*	zero	----	(81 Volts)†	zero	----	----	*Thru 1 megohm †Thru 7 megohms	
	Resist. Coup'd. Amp.	40.5‡	zero	----	(40.5 Volts)‡‡	zero	----	----	‡Thru 1 megohm ‡‡Thru 5 megohms	
1LE3	Amplifier	90	3	1.4	----	2,100	1/8	----		1LE3
		90	zero	4.5	----	zero	----	----		
1LH4	Amplifier	90	zero	0.15	----	zero	----	----		1LH4
1LN5	Amplifier	90*	zero	1.6	0.35, (90 Volts)	zero	----	----	*Thru 1 megohm	1LN5
1LA6	Pentagrid Converter	90	zero	1.75*	0.6, (45 Volts)	zero	----	----	*Sum of osc.-plate & out-plate cur.	1LA6
1N5G 1N5GT	R. F. Amplifier	90	zero	1.2	0.3, (90 Volts)	zero	----	3.2		1N5G 1N5GT
1N6G 1N6GT	Power Amplifier	90	4.5	3.1	0.6, (90 Volts)	1,200	1/8	----		1N6G 1N6GT

(Cont'd on next page)

Grid-Bias Resistor Resistance Values & Wattage Ratings for all Self-Biased Tubes

Tube Type No.	When Used As	Plate Volts	Grid-Bias Volts (Neg.)	Plate Current (Ma.)	Screen Current (Ma.) / Screen Volts	Grid-Bias Resistor (Ohms)	Grid-Bias Resistor Rating (Watts)	Cut-off Bias (Volts)	Special Operating Condition Notes	Tube Type No.
1P5G 1P5GT	R. F. Amplifier	90	zero	2.3	0.7, (90 Volts)	zero	----	12		1P5G 1P5GT
1Q5G 1Q5GT	Power Amplifier	90	4.5	9.5	1.6, (90 Volts)	400	1/8	----		1Q5G 1Q5GT
		85	4.5	8.2	1.4, (90 Volts)	470	1/8	----		
1R5	Pentagrid Converter	90	zero	2.6*	screen is osc.	zero	----	9	*Sum of osc.-plate & out-plate cur.	1R5
		45	zero	2.6*	plate. I_k=2.75	zero	----	9		
1S4	Power Amplifier	45	4.5	3.8	0.8, (45 Volts)	470	1/8	----		1S4
1S5	R.F. Amplifier	45	zero	1.2	0.3, (45 Volts)	zero	----	----		1S5
	Resist. Coup'd. Amp.	41*	zero		series screen resistor=3 meg.	zero	----	----	*Thru 1 megohm	
1T4	R. F. Amplifier	90	zero	2.0	0.65, (45 Volts)	zero	----	----		1T4
		45	zero	1.9	0.7, (45 Volts)	zero	----	----		
1T5GT	Power Amplifier	90	6	6.5	1.4, (90 Volts)	750	1/8	----		1T5GT
2A3	Power Amplifier	250	45	60	----	750	5	----		2A3
2A3H	Power Amplif. (p-p)	300	62(no sig.)	80(2 tubes)	----	780	5	----		2A3H
2A5	Power Amplifier (pentode)	315	22	42	8, (315 Volts)	440	2	----		2A5
		250	16.5	34	6.5, (250 Volts)	410	1	----		
	Triode Converter	250	20	33	----	600	1	----		
	Power Amplifier (pentode, push-pull)	315	22	84(2 tubes)	16, (2 tubes)	220	3	----		
		375	21(no sig.)	54(2 tubes-no sig.)	8, (250 V. 2 tubes-no sig.)	340	2	----		
	Pw'r Amp. (triode p-p)	350	36.5	50(2 tubes-no sig.)	----	730	3	----		
2A6	Imped. Coupled	250	2	0.8	----	2,500	1/8	----		2A6
	Resist.-Coupled Voltage Amplifier	250*	1.35	0.4	----	3,500	1/8	----	*Through a 0.25-meg. plate load	
		180*	1.3	0.24	----	5,000	1/8	----		
		135*	1.1	0.09	----	11,000	1/8	----		
2A7	Pentagrid Converter	250	3	7.5*	2.2, (100 Volts)	300	1/8	45	*Sum of osc.-plate and output-plate currents	2A7
		150	1.5	5.9*	2.8, (50 Volts)	150	1/8	----		
		100	1.5	4.6*	2.5, (50 Volts)	200	1/8	----		
2B7	Voltage Amplifier (R-F, I-F)	250	3	9	2.3, (125 Volts)	250	1/8	21		2B7
		250	3	6	1.5, (100 Volts)	400	1/8	----		
		180	3	3.4	0.9, (75 Volts)	700	1/8	----		
		100	3	5.8	1.7, (100 Volts)	400	1/8	17		
	Resist.-Coupled Amplifier	250*	3	5.4	2, (100 Volts)	400	1/8	----	*Thru 0.027-meg. plateload	
		250†	4.5	0.65	0.15, (50 Volts)	5,500	1/8	----	†Thru 0.25-meg. plateload	
		250‡	5	0.25	0.053, (45 Volts)	17,000	1/8	----	‡Thru 0.5-meg. plate load	
		180	2.1	0.45	0.15, (25 Volts)	3,500	1/8	----		
		135	1.95	0.3	0.1, (20 Volts)	5,000	1/8	----		
		100	2.15	0.23	0.0, (20 Volts)	10,000	1/8	----		
3A8GT	Pentode Amp. Section	90	zero	1.5	0.5, (90 Volts)	zero	----	----		3A8GT
	Triode Amp. Section	90	zero	0.2	----	zero	----	----		
3LE4	Power Amplifier	90	9	10*	2.0, (90 Volts)	750	1/8	----	*Filament sec. in parallel	3LE4
		90	9	9**	1.8, (90 Volts)	850	1/8	----	**Filament sec. in series	
3Q5GT	Power Amplifier	90	4.5	7.5*	1.0, (90 Volts)	550	1/8	----	*Filament sec. in series	3Q5GT
		90	4.5	9.5**	1.6, (90 Volts)	400	1/8	----	**Filament sec. in parallel	
3S4	Power Amplifier	67.5	7	7.2	1.5, (67.5 Volts)	800	1/8	----		3S4
6A26G	Power Amplifier	250	14	78.0*	7.2* (250 Volts)	165	2	----	*Full signal	6A26G
6A3	Power Amplifier	256	45	60	----	750	3	----		6A3
	Pw'r Amplif. (p-p)	325	68(no sig.)	80(2 tubes-no sig.)	----	850	10	----		
6A4/LA	Power Amplifier	180	12	22	3.9, (180 Volts)	500	1/2	----		6A4/LA
		165	11	20	5, (165 Volts)	500	1/2	----		
		135	9	14	2.5, (135 Volts)	550	1/2	----		
		100	6.5	9	1.6, (100 Volts)	600	1/2	----		
	Power Amplifier (push-pull)	230	----	32(2 tubes)	----	700	1	----		
		180	----	----	----	250	1	----		
		165	----	----	----	250	1	----		
		135	----	----	----	250	1/2	----		
		100	----	----	----	300	1/8	----		
6A5G	Power Amplifier	250	45	60	----	750	3	----		6A5G
	Pw'r Amplif. (p-p)	325	68(no sig.)	80(2 tubes-no sig.)	----	850	10	----		
6A6	Driver (Class A)	294	6	7	----	850	1/8	----		6A6
		250	5	6	----	850	1/8	----		
6A7	Pentagrid Converter	250	3	7.5*	2.2, (100 Volts)	300	1/8	45	*Sum of osc.-plate and output-plate currents	6A7
		150	1.5	5.9*	2.8, (50 Volts)	150	1/8	----		
		100	1.5	4.6*	2.5, (50 Volts)	200	1/8	----		
6A8 6A8G 76A8GT	Pentagrid Converter	250	3	7.3*	3.2, (100 Volts)	300	1/8	45	*Sum of osc.-plate & output-plate cur.	6A8 6A8G 76A8GT
		100	1.5	2.8*	1.5, (50 Volts)	350	1/8	----		
6AB7 /1853	R. F. Amplifier	300	3	12.5	3.2, (200 Volts)	190	1/8	22.5		6AB7 /1853
6AC5G 6AC5GT	Power Amplifier	250	zero	5	----	zero	----	----		6AC5G 6AC5GT
6AC6G	Dynamic-Coupled Amplifier	180*	zero	47.0	----	zero			*Output plate	6AC6G
		180†	zero	13.0	----	zero			†Input plate	
6AC7 /1852	R. F. Amplifier	300	2	10	2.5, (60,000-ohm series screen resistor)	160	1/8	----		6AC7 /1852

(Cont'd on next page)

Tube Type No.	When Used As	Plate Volts	Grid-Bias Volts (Neg.)	Plate Current (Ma.)	Screen Current (Ma.) / Screen Volts	Grid-Bias Resistor (Ohms)	Grid-Bias Resistor Rating (Watts)	Cut-off Bias (Volts)	Special Operating Condition Notes	Tube Type No.
6AD7G	Pw'r Pent. Amp. Sec.	250	16.5	36	10.5, (250 Volts)	400	1			6AD7G
	Triode Amplifier Section	250	25*	4		620*	⅛		*In actual circuit use same bias as output tube	
6AE5GT	Amplifier	95	15	7		2,000	⅛			6AE5GT
6AE7G	Driver For Power Amplifier	250	13.5*	5		2,700	⅛		*No bias required in dynamic-coupled circuit	6AE7G
6AF5G	Dynamic-Coupled Amplifier	180	18	13.6*		1,300	⅛		*Sum of output-plate & driver plate cur.	6AF5G
6AG7	Amplifier	300	2	28.0	7.0, (125 Volts)	570	⅛			6AG7
		300	zero	52.0	15.0, (125 Volts*)	zero			*Thru series screen resist.	
6B4G	Power Amplifier	256	45	60		750	3			6B4G
	Pw'r Amplif. (p-p)	325	68(no sig.)	80(2 tubes-no sig.)		850	10			
6B5	Dynamic-Coupled Amplifier	300*	zero	42.0		zero			*Output plate	6B5
		300†	zero	9.0		zero			†Input plate	
6B6G	Imped. Coupled	250	2	0.8		2,500	⅛			6B6G
	Resist.-Coupled Voltage Amplifier	250*	1.35	0.4		3,500	⅛		*Thru a 0.25-meg. plate load	
		180*	1.3	0.24		5,000	⅛			
		135*	1.1	0.09		11,000	⅛			
6B7 6B8 6B8G 6B8GT	Voltage Amplifier (R-F, I-F)	250	3	9	2.3, (125 Volts)	250	⅛	17		6B7 6B8 6B8G 6B8GT
		250	3	6	1.5, (100 Volts)	400	⅛	13		
		180	3	3.4	0.9, (75 Volts)	700	⅛	10		
		100	3	5.8	1.7, (100 Volts)	400	⅛	13		
	Resist.-Coupled Amplifier	250*	3	5.4	2, (100 Volts)	400	⅛		*Thru0.027-meg.plate load	
		250†	4.5	0.65	0.15, (50 Volts)	5,500	⅛		†Thru 0.25-meg.plate load	
		250‡	5	0.25	0.053, (45 Volts)	17,000	⅛		‡Thru 0.5-meg. plate load	
		180	2.1	0.45	0.15, (25 Volts)	3,500	⅛			
		135	1.95	0.3	0.1, (20 Volts)	5,000	⅛			
		100	2.15	0.23	0.0, (20 Volts)	10,000	⅛			
6C5 6C5G 6C5GT	Transf.-Coupl'd Amp.	250	8	8		1,000	⅛			6C5 6C5G 6C5GT
	Resist.-Coupl'd Amplif.	250	5	1.5*		3,500	⅛		*With 0.1meg. plate load	
		250	5	2.5†		2,000	⅛		†With 0.05-meg.plate load	
	Biased Detector	250	17	0.2		85,000	⅛			
6C6	Amplifier (pentode)	250	3	2	0.5, (100 Volts)	1,200	⅛	7		6C6
		100	3	2	0.5, (100 Volts)	1,200	⅛			
		100	1.5	I_b+I_{c2}=2.5 ma. (100 Volts)		600	⅛			
	Amplifier (triode)	250	8	6.5		1,250	⅛			
		180	5.3	5.3		1,000	⅛			
		90	2.5	2		1,250	⅛			
	Push-Pull Amp.(triode)	90	2.5	4(2 tubes)		625	⅛			
	Biased Det. (pentode)	250(a)	4.3	I_k=0.43 ma., no sig. (100 Volts)		10,000	⅛		(a) Thru a 0.5-meg. plate load	
		250(b)	3.86	I_k=0.97 ma. (100 Volts)		4,000	⅛			
		250(a)	1.7	I_k=0.21 ma. (33 Volts)		8,000	⅛		(b) Thru a 0.25-meg. pl. load	
		250(b)	2	I_k=0.65 ma., no sig. (50 Volts)		3,000	⅛			
		100(b)	1.8	I_k=0.183 ma., no sig. (30 Volts)		10,000	⅛		(c) Thru a 1-meg. plate load	
		100(c)	1.2	I_k=0.063 ma., no sig. (12 Volts)		18,000	⅛			
6C8G	Amplifier	250	4.5	3.2 (Each Section)		1,400	⅛			6C8G
	Resist.-Coupled Amplifier	250*	3	1 (Each Section)		1,500 (2 sect.)	⅛		*Thru a 0.1-meg. plate load	
		250†	3	1.7 (Each Section)		900 (2 sect.)	⅛		†Thru a 0.05-meg. plate load	
6D6	Amplifier	250	3	8.2	(100 Volts)	300	⅛	40		6D6
		100	3	8	2.2, (100 Volts)	300	⅛	40		
	Super Mixer	250	10	3	0.5, (100 Volts)	3,000	⅛			
		100	10	3	0.5, (100 Volts)	3,000	⅛			
6D8G	Pentagrid Converter	250	3	I_k=13 ma.		250	⅛	40		6D8G
		135	3	I_k=8 ma.		375	⅛			
6E6	Power Amplifier	250	27.5	18		1,500	½			6E6
		180	20	11.5		1,750	½			
	Power Amplifier (push-pull)	250	27.5	36(2 tubes)		750	1			
		180	20	23(2 tubes)		875	1			
6E8G	Triode-Hexode Converter	250	2	8.0*	1.6, (150 Volts)†	200	⅛	22	*Sum of out.-plate and Triode-plate currents	6E8G
		100	1.5	4.45*	3.0, (100 Volts)†	200	⅛	15	†Triode-plate voltage	
6F5 6F5G 6F5GT	Amplifier	250	2	0.9		2,200	⅛			6F5 6F5G 6F5GT
	Resist.-Coupled Amplifier	250*	1.3	0.2		6,500.	⅛		*Thru a 0.5-meg.plateload	
		250†	1.3	0.5		2,600	⅛		†Thrua0.2-meg.plate load	
6F6 6F6G 6F6GT	Power Amplifier Pentode (one)	315	22	42	8, (315 Volts)	440	2			6F6 6F6G 6F6GT
		250	16.5	34	6.5, (25 Volts)	410	2			
	Triode (one)	250	20	31		650	1			
	Push-Pull Pentodes	315	22(2tubes)	84(2 tubes)	16, (315 Volts)	220	5			
		375	20.4(2tbs)	54(2 tubes)	8, (250 Volts)	340	5			
	Push-Pull Triodes	350	36.5(2tbs)	50(2 tubes)		730	5			
6F7	Amplifier (pentode)	250	3	6.5	1.5, (100 Volts)	375	⅛	35		6F7
		100	3	6.3	1.6, (100 Volts)	375	⅛			
	Amplifier (triode)	100	3	3.5		850	⅛			
	Super. Conv.(pentode)	250	10	5.2*	0.6, (100 Volts)	1,700	⅛		*SumofOsc.&Out.PlateCr.	

(Cont'd on next page

Grid-Bias Resistor Resistance Values & Wattage Ratings for all Self-Biased Tubes

Tube Type No.	When Used As	Plate Volts	Grid-Bias Volts (Neg.)	Plate Current (Ma.)	Screen Current (Ma.) / Screen Volts	Grid-Bias Resistor (Ohms)	Grid-Bias Resistor Rating (Watts)	Cut-off Bias (Volts)	Special Operating Condition Notes	Tube Type No.
6F7	Biased Detector (triode)	250†	——	——	——	5,000	1/8	——	†Thru 0.2 meg.	6F7
		250‡	——	——	——	15,000	1/8	——	‡Thru 0.3 meg.	
	Diode Det. & Pent. A-F Amplif.	250	3	——	(50 Volts)	5,000	1/8	——		
6F8G	Amp. (each-section)	250	8	9	——	900	1/8	——		6F8G
6G6G	Power Amplifier	180	9	15	2.5, (180 Volts)	500	1/2	——		6G6G
		135	6	11.5	2, (135 Volts)	450	1/2	——		
6H8G	Amplifier	250	2	5.7	1.8, (100 Volts)	250	1/8	——		6H8G
		200	2	5.7	1.8, (100 Volts)	250	1/8	——		
		100	2	5.7	1.9, (100 Volts)	250	1/8	——		
6J5 6J5G 6J5GT	Amplifier	250	8	9	——	900	1/8	——		6J5 6J5G 6J5GT
6J7 6J7G 6J7GT	Amplifier (Pent.)	250	3	2	0.5, (100 Volts)	1,200	1/8	7		6J7 6J7G 6J7GT
		100	3	2	0.5, (100 Volts)	1,200	1/8	7		
		100	1.5	I_b+I_{c2}=2.5 ma. (100 V.)		600	1/8	——		
	Amplifier (triode)	250	8	6.5	——	1,250	1/8	——		
		180	5.3	5.3	——	1,000	1/8	——		
		90	2.5	2	——	1,250	1/8	——		
	Amplif. (triode p-p)	90	2.5	4(2 tubes)	——	625	1/8	——		
	Biased Detector	250	4.3	I_k=0.43 ma., no sig. (100 V.)		10,000	1/8	——		
		250	3.86	I_k=0.97 ma., no sig. (100 V.)		4,000	1/8	——		
		250	1.7	I_k=0.21 ma., no sig. (33 V.)		8,000	1/8	——		
		250	2	I_k=0.65 ma., no sig. (50 V.)		3,000	1/8	——		
		100	1.8	I_k=0.183 ma., no sig. (30 V.)		10,000	1/8	——		
		100	1.2	I_k=0.063 ma., no sig. (12 V.)		18,000	1/8	——		
6J8G	Pentagrid Converter	250	3	6.2*	2.8, (100 Volts)	350	1/8	——	*Sum of Osc. & Out. Plate Cr.	6J8G
6K5G	Amplifier	250	3	1.1	——	3,000	1/8	——		6K5G
		100	1.5	0.35	——	4,000	1/8	——		
	Resis.-Coup. Amplif.	250*	2.5	0.37	——	7,000	1/8	——	*Thru 0.25 meg.	
6K6G 6K6GT	Power Amplifier	250	18	32	5.5, (250 Volts)	500	2	——		6K6G 6K6GT
		180	13.5	18.5	3, (180 Volts)	600	2	——		
		167.5	12.5	17	3, (167.5 Volts)	600	2	——		
		135	10	12.5	2.2, (135 Volts)	700	2	——		
		125	10	11	2, (125 Volts)	750	2	——		
		100	7	9	1.6, (100 Volts)	650	2	——		
6K7 6K7G 6K7GT	Amplifier	250	3	10.5	2.6, (125 Volts)	250	1/8	52		6K7 6K7G 6K7GT
		250	3	7	1.7, (100 Volts)	350	1/8	42		
		180	3	4	1, (75 Volts)	600	1/8	——		
		90	3	5.4	1.3, (90 Volts)	450	1/8	38.5		
	Super Mixer	250	10	3	0.5, (100 Volts)	3,000	1/8	——		
6K8 6K8GT	Pentagrid Converter	250	3	6.3*	6, (100 Volts)	250	1/8	——	*Sum of osc.-plate & out.-plate currts.	6K8 6K8GT
		100	3	6.1*	6.2, (100 Volts)	250	1/8	——		
6L5G	Amplifier	250	9	8	——	1,100	1/8	20		6L5G
		135	5	3.5	——	1,400	1/8	——		
		100	3	4	——	750	1/8	——		
6L6 6L6G	Power Output (single tube)	375	9	24	0.7, (125 Volts)	365	2	——		6L6 6L6G
		300	11.8	51	3, (200 Volts)	220	2	——		
		250	13.5	75	5.4, (250 Volts)	170	2	——		
		200	11	55	4.2, (200 Volts)	185	2	——		
	Power Output (p-p) (all values for 2 tubes)	400	23.5	112	7, (300 Volts)	200	5	——		
		400	19	96	4.6, (250 Volts)	190	5	——		
		250	16	120	10, (250 Volts)	125	5	——		
6L7 6L7G	Mixer	250	6	3.3	9.2, (150 Volts)	500	1/8	45		6L7 6L7G
		250	3	2.4	7.1, (100 Volts)	350	1/8	30		
6M7G	Power Amplifier	250	2.5	10.5	2.8, (125 Volts)	200	1/8	——		6M7G
		250	2.5	6.5	1.7, (100 Volts)	320	1/8	——		
		100	2.5	6.2	1.8, (100 Volts)	320	1/8	——		
6M8GT	Pentode Amp. Sec.	100	3	8.5	2.7, (100 Volts)	270	1/8	35		6M8GT
	Triode Amp. Section	100	1	0.5	——	2,000	1/8	——		
6N6G	Dynamic-Coupled Amplifier	300*	zero	42.0	——	zero	——	——	*Output plate	6N6G
		300†	zero	9.0	——	zero	——	——	†Input plate	
6N7 6N7G 6N7GT	Driver (Class A)	294	6	7	——	850	1/8	——		6N7 6N7G 6N7GT
		250	5	6	——	850	1/8	——		
6O6GT	Power Amplifier	200	14.0	62.0*	13.0*, (135 Volts)	190	2	——	*Max. signal	6O6GT
		135	13.5	60.0*	15.0, (135 Volts)	180	1	——		
		110	10.5	47.0*	11.0, (110 Volts)	180	1	——		
6O7G	R. F. Amplifier	250	3.0	8.2	2.0, (100 Volts)	300	1/8	50		6O7G
		100	3.0	8.0	2.2, (100 Volts)	300	1/8	50		
6P5G 6P5GT	Amplifier	250	13.5	5	——	2,700	1/8	——		6P5G 6P5GT
		100	5	2.5	——	2,000	1/8	——		
	Resist.-Coupled Amplifier	250*	9	2	——	4,500	1/8	——	*Thru a 0.05-meg. plate load	
		250†	8	1.2	——	6,500	1/8	——	†Thru a 0.1-meg. plate load	
	Biased Detector	250	20	0.2	——	100,000	1/8	——		
		100	8	0.2	——	40,000	1/8	——		

(Cont'd on next page)

Tube Type No.	When Used As	Plate Volts	Grid-Bias Volts (Neg.)	Plate Current (Ma.)	Screen Current (Ma.) / Screen Volts	Grid-Resistor Bias (Ohms)	Grid-Bias Resistor Rating (Watts)	Cut-off Bias (Volts)	Special Operating Condition Notes	Tube Type No.
6P7G	Amplifier (pent.)	250	3	6.5	1.5, (100 Volts)	375	⅛			6P7G
		100	3	6.3	1.6, (100 Volts)	375	⅛			
	Amplifier (triode)	100	3	3.5		850	⅛			
	Super Conv.	250	10	5.2*	0.6, (100 Volts)	1,700	⅛		*Sum of Osc. & Out. Plate Cr.	
	Biased Detector (triode)	250†	—			5,000	⅛		†Thru a 0.2-meg. plate load	
		250‡	—			15,000	⅛		‡Thru a 0.3 meg.-plate load	
	Diode Det. & Pent. A-F Amp.	250	3		(50 Volts)	5,000	⅛			
6Q7 6Q7G 6Q7GT	Amplifier Resist.-Coupled Amplifier	250	3	1.1		3,000	⅛			6Q7 6Q7G 6Q7GT
		100	1.5	0.35		4,000	⅛			
		250*	2	0.5		4,000	⅛		*Thru a 0.2-meg. plate load	
		100†	1.1	0.25		4,400	⅛		†Thru a 0.15-meg. plate load	
6R7 6R7G 6R7GT	Amplifier Resist.-Coupled Amplifier	250	9	9.5		1,000	⅛			6R7 6R7G 6R7GT
		250*	6	1.3		4,500	⅛		*Thru a 0.1-meg. plate load	
		250†	6.5	2.4		2,500	⅛		†Thru a 0.05-meg. plate load	
		250‡	6.5	0.65		10,000	⅛		‡Thru a 0.25 meg. plate load	
6S6GT	R. F. Amplifier	250	2	13.0	3.0, (100 Volts)	125	⅛	30		6S6GT
6S7 6S7G	Amplifier Super Mixer	250	3	8.5	2, (100 Volts)	300	⅛	40		6S7 6S7G
		135	3	3.7	0.9, (67.5 Volts)	650	⅛	40		
		250	10	I_k=3.5 ma. (100 Volts)		3,000	⅛			
6SA7 6SA7GT	Pentagrid Converter	250	zero	11.4	I_k=11.9, (100 Volts)	zero	—	—		6SA7 6SA7GT
		100	zero	11.2	I_k=11.7, (100 Volts)	zero	—	—		
6SC7	Amplifier	250	2.0	2		1,000	⅛			6SC7
6SD7 6SD7GT	R. F. Amplifier	250	2.0	9.5	3.0, (125 Volts)	165	⅛			6SD7 6SD7GT
		250	2.0	6.0	1.9, (100 Volts)	250	⅛			
		100	2.0	5.7	2.0, (100 Volts)	250	⅛			
6SE7GT	Amplifier	250	1.5	4.5	1.5, (100 Volts)	250	⅛			6SE7GT
		100	1.0	5.5	2.4, (100 Volts)	125	⅛			
6SF5 6SF5GT	Amplifier	250	2	0.9		2,200	⅛			6SF5 6SF5GT
		250*	1.3	0.25		5,200	⅛		*Thru 0.5 megohm	
6SG7	R. F. Amplifier	250	2.5	9.2	3.4, (150 Volts)	200	⅛	17.5		6SG7
		250	1.0	11.8	4.4, (125 Volts)	60	⅛	14		
		100	1.0	8.2	3.2, (100 Volts)	80	⅛	11.5		
6SJ7 6SJ7GT	Amplifier	250	3.0	3.0	0.8, (100 Volts)	800	⅛			6SJ7 6SJ7GT
		100	3.0	2.9	0.9, (100 Volts)	800	⅛			
6SK7 6SK7GT	R. F. Amplifier	250	3.0	9.2	2.4, (100 Volts)	250	⅛	35		6SK7 6SK7GT
		100	3.0	8.9	2.6, (100 Volts)	250	⅛	35		
6SQ7 6SQ7G 6SQ7GT	Amplifier Resistance-Coupled Amplifier	250	2.0	0.9		2,200	⅛			6SQ7 6SQ7G 6SQ7GT
		250*	1.3	0.25		5,200	⅛		*Thru 0.5 megohm	
6SR7	Amplifier	250	9.0	9.5		950	⅛			6SR7
6T6	R. F. Amplifier	250	1.0	10.0	2.0, (100 Volts)	83	⅛	7.5		6T6
6T7G	Amplifier	250	3	1.2		2,500	⅛			6T7G
		135	1.5	0.5		3,000	⅛			
	Res.-Coup. Amplif.	250*	2.5	0.31		8,000	⅛		*Thru a 0.25 meg. plate load	
6V6 6V6G 6V6GT	Power Amplifier Power Amplifier (push-pull)	250	12.5	45	4.5, (250 Volts)	250	2			6V6 6V6G 6V6GT
		180	8.5	29	3, (180 Volts)	250	2			
		300	20	78 (2 tubes)	5, (300 V.) (2 tubes)	250	3			
		250	15	70 (2 tubes)	5, (250 V.) (2 tubes)	200	3			
6V7G	Amplifier	250	20	8		2,500	⅛			6V7G
		180	13.5	6		2,500	⅛			
		135	10.5	3.7		3,000	⅛			
6W6GT	Power Amplifier	135	9.5	61*	12.0*, (135 Volts)	130	1	—	*Max. signal	6W6GT
6W7G	Amplifier (pentode)	250	3	2	0.5, (100 Volts)	1,200	⅛			6W7G
		100	3	2	0.5, (100 Volts)	1,200	⅛			
		100	1.5	I_k=2.5 ma. (100 Volts)		600	⅛			
	Amplifier (triode)	250	8	6.5		1,250	⅛			
		180	5.3	5.3		1,000	⅛			
	Amplif. (p-p triode)	90	2.5	2		1,250	⅛			
		90	2.5	4 (2 tubes)		625	⅛			
	Biased Detector	250	4.3	I_k=0.43 ma., no sig. (100 V.)		10,000	⅛			
		250	3.86	I_k=0.97 ma., no sig. (100 V.)		4,000	⅛			
		250	1.7	I_k=0.21 ma., no sig. (33 V.)		8,000	⅛			
		250	2	I_k=0.65 ma., no sig. (50 V.)		3,000	⅛			
		100	1.8	I_k=0.183 ma., no sig. (30 V.)		10,000	⅛			
		100	1.2	I_k=0.063 ma., no sig. (12 V.)		18,000	⅛			
6Y6G 6Y6GT	Power Amplifier	200	14.0	66.0	9.0, (135 Volts)	190	2			6Y6G 6Y6GT
		135	13.5	60.0	11.5, (135 Volts)	190	1			
6Y7G	Amplifier	250*	1.5	0.5		3,000	⅛		Amplifier Section	6Y7G
6Z7G	Class B Amplifier	180	zero	4.2*		zero	—		*No signal	6Z7G
		135	zero	3.0*		zero	—	—		
7A4	Amplifier	250	8	9.0		900	⅛			7A4
		90	zero	10.0		zero	—	—		
7A5	Power Amplifier	125	9.0	37.5	3.2, (125 Volts)	220	½			7A5
		110	7.5	35.0	3.0, (110 Volts)	200	⅛			
7A7LM	R. F. Amplifier	250	3.0	8.6	2.0, (100 Volts)	280	⅛	35		7A7LM
7A8	Pentagrid Converter	250	3	7.1*	3, (100 Volts)	300	⅛		*Sum of Osc. & Out. Plate Cr.	7A8

(Cont'd on next page)

Grid-Bias Resistor Resistance Values & Wattage Ratings for all Self-Biased Tubes

Tube Type No.	When Used As	Plate Volts	Grid-Bias Volts (Neg.)	Plate Current (Ma.)	Screen Current (Ma.) / Screen Volts	Grid-Bias Resistor (Ohms)	Grid-Bias Resistor Rating (Watts)	Cut-off Bias (Volts)	Special Operating Condition Notes	Tube Type No.
7B4	Amplifier	250	2.0	0.9	———	2,200	⅛	———	———	7B4
7B5 7B5LT	Power Amplifier	315	21	28.0	9.0, (250 Volts)	600	1	———	———	7B5 7B5LT
		200	18	33.0	10.0, (250 Volts)	400	1	———	———	
		100	7.0	9.5	3.0, (100 Volts)	560	⅛	———	———	
7B6 7B6LM	Amplifier Resist. Coupled	250	2.0	0.9	———	2,200	⅛	———	———	7B6 7B6LM
		250*	zero	1.5	———	zero	———	———	*Thru 0.1 meg. plate load	
7B7	R. F. Amplifier	250	3.0	8.5	2.0, (100 Volts)	280	⅛	40	———	7B7
7B8 7B8LM	Pentagrid Converter	250	3.0	7.5	2.7, (100 Volts)	300	⅛	———	———	7B8 7B8LM
		100	1.5	3.3	1.3, (50 Volts)	330	⅛	———	———	
7C5 7C5LT	Power Amplifier (Single Tube)	315	13.0	35.0	6.0, (225 Volts)	300	½	———	———	7C5 7C5LT
		250	12.5	47.0	7.0, (250 Volts)	230	1	———	———	
		180	8.5	30.0	4.0, (180 Volts)	250	½	———	———	
	Push-Pull	250	15.0	79.0	13.0, (250 Volts)	165	2	———	———	
7C6	Resist. Coup'd Amp.	250*	zero	———	———	zero	———	———	*Thru 0.25 megohms. (Grid resistor, 10 meg.)	7C6
7C7	Amplifier	250	3.0	2.0	0.5, (100 Volts)	1,200	⅛	———	———	7C7
		100	3.0	1.8	0.4, (100 Volts)	950	⅛	———	———	
7D7	Triode-Hexode Conv. (Hexode Sect.)	250	3.0	1.3	2.8, (100 Volts)		⅛	———	———	7D7
	Triode Section	250*	———	5.0	———	330	———	———	*Thru 20,000 ohms	
7E6	Amplifier	250	9.0	9.5	———	950	⅛	———	———	7E6
7E7	R. F. Amplifier	250	3.0	7.5	1.6, (100 Volts)	330	⅛	42.5	———	7E7
7F7	Amplifier	250	2.0	2.3	———	850	⅛	———	———	7F7
	Resist. Coup'd Amp.	250*	1.0	0.5	———	2,000	⅛	———	*Thru 0.25 megohms	
7G7/1232	R. F. Amplifier	250	2.0	6.0	2.0, (100 Volts)	250	⅛	6	———	7G7/1232
7H7	R. F. Amplifier	250	2.5	9.0	2.5, (150 Volts)	220	⅛	———	———	7H7
		100	1.0	8.5	3.5, (100 Volts)	83	⅛	———	———	
7J7	Triode-Hexode Conv. Hexode Section	250	3.0	1.4	2.8, (100 Volts)	300	⅛	———	———	7J7
	Triode Section	250*	zero	5.7	———				*Thru 20,000 ohms	
7L7	R. F. Amplifier	250	1.5	4.5	1.5, (100 Volts)	250	⅛	———	———	7L7
		100	1.0	5.5	2.4, (100 Volts)	125	⅛	———	———	
7N7	Amp. (Each Section)	250	8.0	9.0	———	900	⅛	———	———	7N7
7Q7	Pentagrid Converter	250	zero	3.4	8.0, (100 Volts)	zero	———	35	———	7Q7
		100	zero	3.2	8.0, (100 Volts)	zero	———	35	———	
7V7	Amplifier	300	2.2	9.6	3.9, (300V thru 40,000 ohms)	160	¼	14	———	7V7
		300	2.2	9.6	3.9, (150 Volts)	160	¼	6	———	
10	Power Amplifier	425	40	18	———	2,000	1	———	———	10
		350	32	16	———	2,000	1	———	———	
		250	23.5	10	———	2,350	½	———	———	
11 WD11 WX12	Amplifier	135	10.5	3	———	3,500	⅛	———	———	11 WD11 WX12
		90	4.5	2.5	———	1,800	⅛	———	———	
	Biased Detector	135	18	0.2	———	90,000	⅛	———	———	
		90	10.5	0.2	———	50,000	⅛	———	———	
12A5	Power Amplifier	180	27	38	8, (180 Volts)	600	2	———	———	12A5
		100	15	17	3, (100 Volts)	750	1	———	———	
12A6	Power Amplifier	250	12.5	30.0	3.5, (250 Volts)	375	½	———	———	12A6
12A7	Power Amplifier	135	13.5	9	2.5, (135 Volts)	1,000	1	———	———	12A7
12A8G 12A8GT	Pentagrid Converter	250	3.0	7.3*	3.2, (100 Volts)	300	⅛	45	*Sum of osc.-plate & output-plate cur.	12A8G 12A8GT
		100	1.5	2.8*	1.5, (50 Volts)	350	⅛	———		
12B7	R. F. Amplifier	250	3.0	9.2	2.4, (100 Volts)	250	⅛	35	———	12B7
		100	3.0	8.9	2.6, (100 Volts)	250	⅛		———	
12C8	R. F. Amplifier	250	3.0	9.0	2.3, (125 Volts)	250	⅛	17	———	12C8
		250	3.0	6.0	1.5, (100 Volts)	400	½	13	———	
		180	3.0	3.4	0.9, (75 Volts)	700	⅛	10	———	
		100	3.0	5.8	1.7, (100 Volts)	400	⅛	13	———	
	Resist.-Coupled Amplifier	250*	3.0	5.4	2.0, (100 Volts)	400	⅛	———	*Thru 0.29-meg. plateload	
		250†	4.5	0.65	0.15, (50 Volts)	5,500	⅛	———	†Thru 0.25-meg. plateload	
		250‡	5.0	0.25	0.053, (45 Volts)	17,000	⅛	———	‡Thru 0.5-meg. plateload	
		180	2.1	0.45	0.15, (25 Volts)	3,500	⅛	———	———	
		135	1.95	0.3	0.1, (20 Volts)	5,000	⅛	———	———	
		100	2.15	0.23	Negligible (20 Volts)	10,000	⅛	———	———	
12E5GT	Amplifier	250	13.5	5.0	———	2,700	⅛	———	———	12E5GT
		100	5.0	2.5	———	2,000	⅛	———	———	
	Resist. Coup'd Amp.	250*	8.0	1.2	———	6,500	⅛	———	*Thru 0.1-meg. plate load	
	Biased Detector	250	20.0	0.2	———	100,000	⅛	———	———	
		100	8.0	0.2	———	40,000	⅛	———	———	
12F5GT	Amplifier	250	2.0	0.9	———	2,200	⅛	———	———	12F5GT
		100	zero	1.8	———	zero	———	———	(Grid resistor 10 meg.)	
12J5GT	Amplifier	250	8.0	9.0	———	900	⅛	———	———	12J5GT
		90	zero	10.0	———	zero	———	———	(Grid resistor 10 meg.)	
12J7G 12J7GT	Amplifier (Pentode)	250	3.0	2.0	0.5, (100 Volts)	1,200	⅛	7	———	12J7G 12J7GT
		100	3.0	2.0	0.5, (100 Volts)	1,200	⅛	7	———	
		100	1.5	I_b+I_{c2}=2.5 ma., (100 Volts)		600	⅛	———	———	
	Amplifier (Triode)	250	8.0	6.5	———	1,250	⅛	———	———	
		180	5.3	5.3	———	1,000	⅛	———	———	
		90	2.5	2.0	———	1,250	⅛	———	———	

(Cont'd on next page)

Tube Type No.	When Used As	Plate Volts	Grid-Bias Volts (Neg.)	Plate Current (Ma.)	Screen Current (Ma.) / Screen Volts	Grid-Bias Resistor (Ohms)	Grid-Bias Resistor Rating (Watts)	Out-off Bias (Volts)	Special Operating Condition Notes	Tube Type No.
12J7G 12J7GT (Cont.)	Amp.Triode push-pull)	90	2.5	4.0 (2 tubes)		625	⅛	—		12J7G 12J7GT (Cont.)
	Biased Detector	250	4.3	I_k=0.43 ma., no sig. (100 Volts)		10,000	⅛	—		
		250	3.86	I_k=0.97 ma., no sig. (100 Volts)		4,000	¼	—		
		250	1.7	I_k=0.21 ma., no sig. (33 Volts)		8,000	⅛	—		
		250	2.0	I_k=0.65 ma., no sig. (59 Volts)		3,000	⅛	—		
		100	1.8	I_k=0.183 ma., no sig. (30 Volts)		10,000	⅛	—		
		100	1.2	I_k=0.063 ma., no sig. (12 Volts)		18,000	⅛	—		
12K7G 12K7GT	Amplifier	250	3.0	10.5	2.6, (125 Volts)	250	⅛	52		12K7G 12K7GT
		250	3.0	7.0	1.7, (100 Volts)	350	⅛	42		
		180	3.0	4.0	1.0, (75 Volts)	600	⅛	—		
		90	3.0	5.4	1.3, (90 Volts)	450	⅛	38.5		
	Mixer	250	10.0	3.0	0.5, (100 Volts)	3,000	⅛	—		
12K8 12K8GT	Pentagrid Converter	250	3.0	6.3*	6.0, (100 Volts)	250	⅛	—	*Sum of osc.-plate & out.-plate cur.	12K8 12K8GT
		100	3.0	6.1*	6.2, (100 Volts)	250	⅛	—		
12SA7 12SA7G 12SA7GT	Pentagrid Converter	250	zero	11.4	I_k=11.9, (100 Volts)	zero	—	—		12SA7 12SA7G 12SA7GT
		100	zero	11.2	I_k=11.7, (100 Volts)	zero	—	—		
12SC7	Amplifier	250	2.0	2.0		1,000	⅛	—		12SC7
12SF5 12SF5GT	Amplifier	250	2.0	0.9		2,200	⅛	—		12SF5 12SF5GT
		250*	1.3	0.25		5,200	⅛	—	*Thru 0.5 megohm	
12SG7	R. F. Amplifier	250	2.5	9.2	3.4, (150 Volts)	200	⅛	17.5		12SG7
		250	1.0	11.8	4.4, (125 Volts)	60	⅛	14		
		100	1.0	8.2	3.2, (100 Volts)	80	¼	11.5		
12SJ7 12SJ7GT	Amplifier	250	3.0	3.0	0.8, (100 Volts)	800	⅛	—		12SJ7 12SJ7GT
		100	3.0	2.9	0.9, (100 Volts)	800	⅛	—		
12SK7 12SK7G	R. F. Amplifier	250	3.0	9.2	2.4, (100 Volts)	250	⅛	35		12SK7 12SK7G
		100	3.0	8.9	2.6, (100 Volts)	250	⅛	35		
12SQ7 12SQ7GT	Amplifier	250	2.0	0.9		2,200	⅛	—		12SQ7 12SQ7GT
	Resist. Coupl'd Amp.	250*	1.3	0.25		5,200	⅛	—	*Thru 0.5 megohm	
12SR7	Amplifier	250	9.0	9.5		950	⅛	—		12SR7
14A5	Power Amplifier	250	12.5	32.0*	5.0*, (250 Volts)	350	½	—	*Max. signal	14A5
14B6	Amplifier	250	2.0	0.9		2,200	⅛	—		14B6
		100	1.0	0.25		4,000	⅛	—		
14B8	Pentagrid Converter	250	3.0	7.5	2.7, (250 Volts*)	300	⅛	35	*Thru 20,000 ohms	14B8
		100	1.5	3.1	1.3, (100 Volts)	350	⅛	20		
14C5	Power Amplifier	315	13.0	35.0*	6.0*, (225 Volts)	300	1	—	*Max. signal	14C5
		250	12.5	47.0*	7.0*, (250 Volts)	230	1	—		
		180	8.5	30.0*	4.0*, (180 Volts)	250	½	—		
	Push Pull	285	19.0	92.0*	13.5*, (285 Volts)	180	2	—		
		250	15.0	79.0*	13.0*, (250 Volts)	165	2	—		
14C7	Amplifier	250	3.0	2.2	0.7, (100 Volts)	1,000	⅛	—		14C7
		100	1.0	5.7	1.8, (100 Volts)	135	⅛	—		
14E6	Amplifier	250	9	9.5		1,000	⅛	—		14E6
14F7	Amplifier	250	2.0	2.3		850	⅛	—		14F7
14H7	R. F. Amplifier	250	2.5	9.5	3.5, (150 Volts)	200	⅛	22		14H7
		100	1.0	8.2	3.3, (100 Volts)	87	⅛	19		
14N7	Amplifier-Phase Inverter	250	5.5	2.4*		1,150	⅛	—		14N7
		100	2.25	1.5*		750	⅛	—	*Per section	
14Q7	Heptode Converter	250	2.0	3.5	8.5, (100 Volts)	165	⅛	—		14Q7
		100	2.0	3.3	8.5, (100 Volts)	165	⅛	—		
14J7	Triode-Hexode Conv. (Hexode Section)	250	3.0	1.4	2.8, (100 Volts)	300	⅛	—		14J7
	(Triode Section)	250*	—	5.7					*Thru 20,000 ohms	
15	Amplifier	135	1.5	1.85	0.3, (67.5 Volts)	750	⅛	—		15
		67.5	1.5	1.85	0.3, (67.5 Volts)	750	⅛	—		
19	Power Amplifier	135	6	25		250	½	—		19
		135	3	25		125	½	—		
20	Power Amplifier	135	22.5	6.5		3,500	⅛	—		20
		90	16.5	3		5,500	⅛	—		
20J8	Converter (Output Section)	250	3.0	1.5	3.4, (100 Volts)	260	⅛	—		20J8
	(Oscillator Section)	250*	—	6.5					*Thru 20,000 ohms	
21A7	Triode-Hexode Conv. (Hexode Section)	250	3.0	1.3	2.8, (100 Volts)	340	⅛	—		21A7
	(Triode Section)	250*	—	5.0					*Thru 20,000 ohms	
22	Amplifier	135	1.5	3.7	1.3, (67.5 Volts)	300	⅛	—		22
		135	1.5	1.7	0.6, (45 Volts)	650	⅛	—		
24A	Amplifier	250	5	4	1.7, (90 Volts)	500	⅛	15		24A
		180	3	4	1.7, (90 Volts)	500	⅛	15		
	Biased Detector	250*	5	0.1	0.05, (45 Volts)	30,000	⅛	—	*Thrua0.25-meg.plateload	
25A6 25A6G	Power Amplifier	180	20	38	7.5, (135 Volts)	440	1	—		25A6 25A6G
		135	20	37	8, (135 Volts)	440	1	—		
		95	15	20	4, (90 Volts)	625	1	—		
25A7G	Power Amplifier	100	15	20.5	4, (100 Volts)	625	1	—		25A7G
25AC5GT	Class B Amplifier	180	zero	4.0*		zero.	—	—	*No signal	25AC5GT

(Cont'd on next page)

Grid-Bias Resistor Resistance Values & Wattage Ratings for all Self-Biased Tubes

Tube Type No.	When Used As	Plate Volts	Grid-Bias Volts (Neg.)	Plate Current (Ma.)	Screen Current (Ma.) / Screen Volts	Grid-Bias Resistor (Ohms)	Grid-Bias Resistor Rating (Watts)	Cut-off Bias (Volts)	Special Operating Condition Notes	Tube Type No.
25B6G	Power Amplifier	135	22	61	2.5, (135 Volts)	350	2	.....		25B6G
		105	16	48	2, (105 Volts)	300	2	.....		
		95	15	41	1.5, (95 Volts)	300	2	.....		
25B8GT	Pentode Section	100	3.0	7.6	2.0, (100 Volts)	300	⅛	41		25B8GT
	Triode Section	100	1.0	0.6	.....	1,650	⅛	2.5		
25C6G	Power Amplifier	200	14.0	66.0*	9.0*, (135 Volts)	190	2	.....	*Max. signal	25C6G
		135	13.5	60.0*	11.5*, (135 Volts)	190	1	.....		
25D8GT	Pentode Amp. Section	100	3.0	8.5	2.7, (100 Volts)	270	⅛	35		25D8GT
	Triode Amp. Section	100	1.0	0.5	.....	2,000	⅛	.....		
25L6 25L6G 25L6GT	Power Amplifier	110	7.5	49	4, (110 Volts)	150	1	.....		25L6 25L6G 25L6GT
26	Amplifier	180	14.5	6.2	.....	2,500	⅛	.....		26
		135	10	5.5	.....	2,000	⅛	.....		
		90	7	2.9	.....	2,500	⅛	.....		
27	Amplifier	250	21	5.2	.....	4,000	⅛	.....		27
		180	13.5	5	.....	2,700	⅛	.....		
		135	9	4.5	.....	2,000	⅛	.....		
		90	6	2.7	.....	2,000	⅛	.....		
	Biased Detector	275	33	0.2	.....	150,000	⅛	.....		
		250	30	0.2	.....	150,000	⅛	.....		
30	Amplifier	180	13.5	3.1	.....	4,350	⅛	.....		30
		135	9	3	.....	3,000	⅛	.....		
		90	4.5	2.5	.....	1,800	⅛	.....		
	Pw'r Amplif. (p-p)	157.5	15	29(2 tubes)	.....	500	1	.....		
	Biased Detector	180	18	0.2	.....	90,000	⅛	.....		
		135	13.5	0.2	.....	67,500	⅛	.....		
		90	9	0.2	.....	45,000	⅛	.....		
31	Power Amplifier	180	30	12.3	.....	2,500	½	.....		31
		135	22.5	8	.....	3,000	½	.....		
32	Amplifier	180	3	1.7	0.4, (67.5 Volts)	1,500	⅛	9		32
		135	3	1.7	0.4, (67.5 Volts)	1,500	⅛	9		
		180	1	0.25	0.1, (30 Volts)	3,000	⅛	.....		
	Biased Detector	180	6	0.2	0.05, (67.5 Volts)	25,000	⅛	.....		
		135	4.5	0.2	0.05, (45 Volts)	20,000	⅛	.....		
33	Power Amplifier	180	18	22	5, (180 Volts)	650	⅛	.....		33
		135	13.5	14.5	3, (135 Volts)	750	⅛	.....		
34	Amplifier	180	3	2.8	1, (67.5 Volts)	800	⅛	22.5		34
		135	3	2.8	1, (67.5 Volts)	800	⅛	22.5		
		67.5	3	2.8	1, (67.5 Volts)	800	⅛	22.5		
	Super Mixer	180	5	1.8	1, (67.5 Volts)	1,800	⅛	.....		
		135	5	1.8	1, (67.5 Volts)	1,800	⅛	.....		
		67.5	5	1.7	1.1, (67.5 Volts)	1,800	⅛	.....		
35	Amplifier	250	3	6.5	2.5, (90 Volts)	350	⅛	40		35
		180	3	6.3	2.5, (90 Volts)	350	⅛	40		
	Super Mixer	250	7	3.7	2.5, (90 Volts)	1,000	⅛	.....		
35A5LT	Power Amplifier	110	7.5	41.0	7.0, (110 Volts)	160	½	.....		35A5LT
35L6G 35L6GT	Power Amplifier	110	7.5	41.0	7.0, (110 Volts)	160	½	.....		35L6G 35L6GT
36	Amplifier	250	3	3.2	1.7, (90 Volts)	600	⅛	8		36
		180	3	3.1	1.8, (90 Volts)	600	⅛	.....		
		135	1.5	2.8	0.4, (67.5 Volts)	500	⅛	.....		
		100	1.5	1.8	0.4, (55 Volts)	750	⅛	6		
	Biased Detector	250*	8	0.1	(90 Volts)	80,000	⅛	.....	*Thru a 0.25-meg. plate load	
		180*	6	0.1	(67.5 Volts)	60,000	⅛	.....		
		100*	5	0.1	(55 Volts)	50,000	⅛	.....		
37	Amplifier	250	18	7.5	.....	2,500	⅛	30		37
		180	13.5	4.3	.....	3,000	⅛	.....		
		135	9	4.1	.....	2,500	⅛	.....		
		90	6	2.5	.....	2,500	⅛	10		
	Biased Detector	250	28	0.2	.....	150,000	⅛	.....		
		180	20	0.2	.....	100,000	⅛	.....		
		135	15	0.2	.....	75,000	⅛	.....		
		90	10	0.2	.....	50,000	⅛	.....		
38	Power Amplifier	250	25	22	3.8, (250 Volts)	1,000	1	.....		38
		180	18	14	2.4, (180 Volts)	1,000	½	.....		
		135	13.5	9	1.5, (135 Volts)	1,300	½	.....		
		100	9	7	1.2, (100 Volts)	1,100	½	.....		
39/44	Amplifier	250	3	5.8	1.4, (90 Volts)	400	⅛	42.5		39/44
		180	3	5.8	1.4, (90 Volts)	400	⅛	42.5		
		90	3	5.6	1.6, (90 Volts)	400	⅛	42.5		
	Super Mixer	250	7	2.5	1, (90 Volts)	2,000	⅛	.....		
		180	7	2.4	1, (90 Volts)	2,000	⅛	.....		
		90	7	2.4	1, (90 Volts)	2,000	⅛	.....		

(Cont'd on next page)

Tube Type No.	When Used As	Plate Volts	Grid-Bias Volts (Neg.)	Plate Current (Ma.)	Screen Current (Ma.) / Screen Volts	Grid-Bias Resistor (Ohms)	Grid-Bias Resistor Rating (Watts)	Out-of Bias (Volts)	Special Operating Condition Notes	Tube Type No.
40	Amplifier	180	3	0.2		15,000	⅛			
		135	1.5	0.2		7,500	⅛			
	Biased Detector	180*	4.5	0.08		50,000	⅛		*Thru a 0.25-meg. plate load	
		135*	3	0.07		40,000	⅛			
41	Power Amplifier	250	18	32	5.5, (250 Volts)	500	2			41
		180	13.5	18.5	3, (180 Volts)	600	2			
		167.5	12.5	17	3, (167.5 Volts)	600	2			
		135	10	12.5	2.2, (135 Volts)	700	2			
		125	10	11	2, (125 Volts)	750	2			
		100	7	9	1.6, (100 Volts)	650	2			
42	Power Amplifier Pentode (one)	315	22	42	8, (315 Volts)	440	2			42
		250	16.5	34	6.5, (250 Volts)	410	2			
	Pw'rAmplif.(triode-1)	250	20	31		650	1			
	Pw'r Amplif. Pentode (push-pull)	315	22(2 tubes)	84(2 tubes)	16, (315 Volts)	220	5			
		375	20.4(nosig.)	54(2tubes,no sig.)	8, (250 Volts)	340	5			
	Pw'rAmp.Triode(p-p)	350	36.5(2tubes no sig.)	50 (2 tubes, no sig).		730	5			
43	Power Amplifier	180	20	38	7.5, (135 Volts)	440	1			43
		135	20	37	8, (135 Volts)	440	1			
		95	15	20	4, (90 Volts)	625	1			
45	Power Amplifier (one)	275	56	36		1,600	5			45
		250	50	34		1,500	5			
		180	31.5	31		1,000	5			
	Pw'r Amplif. (p-p)	275	———	36 no sig. 90 full sig.	Two tubes	775	5			
46	Pw'r Amplif. (triode)	250	33	22		1,500	1			46
47	Power Amplifier	250	16.5	31	6, (250 Volts)	450	1			47
48	Power Amplifier (tetrode)	125	20	56	9.5, (100 Volts)	300	2			48
		96	19	52	9, (96 Volts)	300	2			
	Power Amplifier (triode)	125	32.5	52		625	2			
		80	20	31		650	2			
	Pw'r Amplif. Tetrode (p-p)	125	20	100(2tubes,no sig.)	29, (100 Volts)	155	2			
	Pw'r Amplif. Triode (p-p)	125	32.5	100(2tubes,no sig.)		325	2			
49	Power Amplifier	135	20	6		3,300	½			49
50	Power Amplifier	450	84	55		1,500	5			50
		400	70	55		1,300	5			
		350	63	45		1,400	5			
		300	54	35		1,500	5			
50A5	Power Amplifier	200	8	55.0	6.0, (110 Volts)	130	½			50A5
		110	7.5	50.0	11.0, (110 Volts)	120	½			
50C6G	Power Amplifier	200	14.0	66.0*	9.0*, (135 Volts)	190	2		*Max. signal	50C6G
		135	13.5	60.0*	11.5*, (135 Volts)	190	1			
50L6GT	Power Amplifier	110	7.5	50.0	11.0, (110 Volts)	125	½			50L6GT
53	Amplifier	294	6	7		850	⅛			53
		250	5	6		850	⅛			
55	Amplifier	250	20	8		2,500	⅛			55
		180	13.5	6		2,250	⅛			
		135	10.5	3.7		3,000	⅛			
	Resist.-Coupled Amplifier	180*	7	0.47		15,000	⅛		*Thru a 0.25-meg. plate load	
		135*	7	0.31		20,000	⅛			
		100*	5	0.23		20,000	⅛			
56	Amplifier	250	13.5	5		2,700	⅛			56
		100	5	2.5		2,000	⅛			
	Resist.-Coupled Amplifier	250*	9	2		4,500	⅛		*Thrua0.05-meg.plateload	
		250†	8	1.2		6,500	⅛		†Thrua0.1-meg.plateload	
	Biased Detector	250	20	0.2		100,000	⅛			
		100	8	0.2		40,000	⅛			
57	Amplifier (pentode)	250	3	2	0.5, (100 Volts)	1,200	⅛	7		57
		100	3	2	0.5, (100 Volts)	1,200	⅛			
		100	1.5	I_k=2.5 ma., (100 Volts)		600	⅛			
	Amplifier (triode)	250	8	6.5		1,250	⅛			
		180	5.3	5.3		1,000	⅛			
		90	2.5	2		1,250	⅛			
	Amplif. p-p triode	90	2.5	4 (2 tubes)		625	⅛			
	Biased Detector	250	4.3	I_k=0.43 ma., no sig. (100 V.)		10,000	⅛			
		250	3.86	I_k=0.97 ma., no sig. (100 V.)		4,000	⅛			
		250	1.7	I_k=0.21 ma., no sig. (33 V.)		8,000	⅛			
		250	2	I_k=0.65 ma., no sig. (50 V.)		3,000	⅛			
		100	1.8	I_k=0.183 ma., no sig. (30 V.)		10,000	⅛			
		100	1.2	I_k=0.063 ma., no sig. (12 V.)		8,000	⅛			
58	Amplifier	250	3	8.2	2, (100 Volts)	300	⅛	50		58
		100	3	8	2.2, (100 Volts)	300	⅛			
	Super Mixer	250	10	3	0.5, (100 Volts)	3,000	⅛			
		100	10	3	0.5, (100 Volts)	3,000	⅛			
59	Pw'r Amplif. (triode)	250	28	26		1,000	1			59
	Pw'r Amplif. (pent.)	250	18	35	9, (250 Volts)	400	1			

(Cont'd on next page)

Grid-Bias Resistor Resistance Values & Wattage Ratings for all Self-Biased Tubes

Tube Type No.	When Used As	Plate Volts	Grid-Bias Volts (Neg.)	Plate Current (Ma.)	Screen Current (Ma.) / Screen Volts	Grid-Bias Resistor (Ohms)	Grid-Bias Resistor Rating (Watts)	Cut-off Bias (Volts)	Special Operating Condition Notes	Tube Type No.
70A7GT	Power Amplifier	110	7.5	40.0	3.0, (110 Volts)	175	½			70A7GT
70L7GT	Power Amplifier	110	7.5	43.0	6.0, (110 Volts)	150	½			70L7GT
71A	Power Amplifier	180	40.5	20		2,000	1			71A
		135	27	17.3		1,600	½			
		90	16.5	10		1,650	½			
75	Amplifier	250	2	0.8		2,500	⅛			75
	Resist.-Coupled Amplifier	250*	1.35	0.4		3,500	⅛		*Thru a 0.25-meg. plate load	
		180*	1.3	0.24		5,500	⅛			
		135*	1.1	0.19		5,500	⅛			
76	Amplifier	250	13.5	5		2,700	⅛			76
		100	5	2.5		2,000	⅛			
	Resist.-Coupl'd Amp.	250*	8	1.2		6,500	⅛		*Thrua0.1-meg.plateload	
	Biased Detector	250	20	0.2		100,000	⅛			
		100	8	0.2		40,000	⅛			
77	Amplifier	250	3	2.3	0.5, (100 Volts)	1,000	⅛	7.5		77
		100	1.5	1.7	0.4, (60 Volts)	700	⅛			
	Biased Detector	250	4.3	I_k=0.43 ma., no sig. (100 V.)		10,000	⅛			
		250	1.95	I_k=0.65 ma., no sig. (50 V.)		3,000	⅛			
		100	1.95	I_k=0.155 ma., no sig. (36 V.)		12,500	⅛			
78	Amplifier	250	3	10.5	2.6, (125 Volts)	250	⅛			78
		250	3	7	1.7, (100 Volts)	350	⅛	42.5		
		180	3	4	1, (75 Volts)	600	⅛			
		90	3	5.4	1.3, (90 Volts)	450	⅛			
	Super Mixer	250	10	3	0.5, (100 Volts)	3,000	⅛			
79	Amplifier	250*	1.5	0.5		3,000	⅛		*Thrua0.25-meg.plateload	79
85	Amplifier	250	20	8		2,500	⅛			85
		180	13.5	6		2,250	⅛			
		135	10.5	3.7		3,000	⅛			
	Resist.-Coupled Amplifier	180*	7	0.47		15,000	⅛		*Thru a 0.25-meg. plate load	
		135*	7	0.31		20,000	⅛			
		100*	5	0.23		20,000	⅛			
89	Amplifier (triode)	250	31	32		1,000	2			89
		180	22.5	20		1,100	1			
		160	20	17		1,200	1			
	Amplifier (pentode)	250	25	32	5.5, (250 Volts)	650	1			
		180	18	20	3, (180 Volts)	800	1			
		135	13.5	14	2.2, (135 Volts)	850	1			
		100	10	9.5	1.6, (100 Volts)	900	1			
99	Amplifier	90	4.5	2.5		1,800	⅛			99
	Biased Detector	90	10.5	0.2		50,000	⅛			
112A	Power Amplifier	180	13.5	7.7		1,750	⅛			112A
		135	9	6.2		1,500	⅛			
		90	4.5	5		900	⅛			
	Biased Detector	180	21	0.2		100,000	⅛			
		135	15	0.2		75,000	⅛			
117L7GT	Power Amplifier	105	5.5	45.0	4.0, (105 Volts)	110	⅓			117L7GT
117M7GT	Power Amplifier	100	5.5	50.0	4.5, (110 Volts)	100	½			117M7GT
117N7 117N7GT	Power Amplifier	100	6.0	51.0	5.0, (100 Volts)	100	½			117N7 117N7GT
117P7GT	Power Amplifier	105	5.2	43.0	5.5, (105 Volts)	100	½			117P7GT
182B	Power Amplifier	250	35	20		1,750	2			182B
183	Power Amplifier	250	65	20		3,250	2			183
210T	Power Amplifier	425	40	18		2,000	1			210T
		350	32	16		2,000	1			
		250	23.5	10		2,350	½			
482B	Power Amplifier	250	35	20		1,750	2			482B
483	Power Amplifier	250	65	20		3,250	2			483
485	Amplifier	180	9	5.8		1,600	⅛			485
840	Amplifier	180	3	1	0.7, (67.5 Volts)	1,750	⅛			840
841	Amplifier	1,000	9	2.2		4,000	⅛			841
		425	6	0.7		8,500	⅛			
842	Power Amplifier	525	100	28		3,500	5			842
		422	72	34		2,000	5			
864	Amplifier	135	9	3.5		2,500	⅛			864
		90	4.5	2.9		1,500	⅛			
	Biased Detector	135	15	0.2		75,000	⅛			
		90	10.5	0.2		50,000	⅛			
950	Power Amplifier	135	16.5	7	2, (135 Volts)	1,850	⅛			950
954	Amplifier	250	3	2	0.7, (100 Volts)	1,100	⅛			954
		90	3	1.2	0.5, (90 Volts)	1,750	⅛			
	Biased Detector	250*	6	0.1	(100 Volts)	20,000 to 50,000	⅛		*Thru a 0.25-meg. plate load	
955	Amplifier	180	5	4.5		1,100	⅛			955
		135	3.75	3.5		1,000	⅛			
		90	2.5	2.5		1,000	⅛			
	Res.-Coupl'd Amplif.	180*	3.5	0.42		8,500	⅛		*Thrua0.25-meg.plateload	

(Cont'd on next page)

Tube Type No.	When Used As	Plate Volts	Grid-Bias Volts (Neg.)	Plate Current (Ma.)	Screen Current (Ma.) / Screen Volts	Grid-Bias Resistor (Ohms)	Grid-Bias Resistor Rating (Watts)	Cut-off Bias (Volts)	Special Operating Condition Notes	Tube Type No.
956	Amplifier	250	3	5.5	1.8, (100 Volts)	400	1/8	—		956
	Super Mixer	250	10	1.8	0.5, (100 Volts)	4,000	1/8	—		
1603	Amplifier (pentode)	250	3	2	0.5, (100 Volts)	1,200	1/8	7		1603
		100	3	2	0.5, (100 Volts)	1,200	1/8	—		
		100	1.5	I_k=2.5 ma. (100 Volts)		600	1/8	—		
	Amplifier (triode-1)	250	8	6.5	—	1,250	1/8	—		
		180	5.3	5.3	—	1,000	1/8	—		
		90	2.5	2	—	1,250	1/8	—		
	Amplifier (triode p-p)	90	2.5	4 (2 tubes)	—	625	1/8	—		
	Biased Detector	250	4.3	I_k=0.43 ma., no sig. (100 V.)		10,000	1/8	—		
		250	3.86	I_k=0.97 ma., no sig. (100 V.)		4,000	1/8	—		
		250	1.7	I_k=0.21 ma., no sig. (33 V.)		8,000	1/8	—		
		250	2	I_k=0.65 ma., no sig. (50 V.)		3,000	1/8	—		
		100	1.8	I_k=0.183 ma., no sig. (30 V.)		10,000	1/8	—		
		100	1.2	I_k=0.063 ma., no sig. (12 V.)		18,000	1/8	—		
1609	Amplifier	135	1.5	2.5	0.65, (67.5 Volts)	500	1/8	—		1609
1612	Pentagrid Amplifier	250	3	5.3	6.5, (100 Volts)	250	1/8	—		1612
1851 1852	Television Amplifier	300	2	10	2.5, (150 Volts)	160	1/8	—		1851 1852
1853	Television Amplifier	300	3	12.5	3.2, (200 Volts)	200	1/8	—		1853
7000 7700	Amplifier (pentode)	250	3	2	0.5, (100 Volts)	1,200	1/8	—		7000 7700
		100	3	2	0.5, (100 Volts)	1,200	1/8	—		
		100	1.5	I_k=2.5 ma. (100 Volts)		600	1/8	—		
	Amplifier (triode)	250	8	6.5	—	1,250	1/8	—		
		180	5.3	5.3	—	1,000	1/8	—		
		90	2.5	2	—	1,250	1/8	—		
	Amplifier (triode p-p)	90	2.5	4 (2 tubes)	—	625	1/8	—		
	Biased Detector	250	4.3	I_k=0.43 ma., no sig. (100 V.)		10,000	1/8	—		
		250	3.86	I_k=0.97 ma., no sig. (100 V.)		4,000	1/8	—		
		250	1.7	I_k=0.21 ma., no sig. (33 V.)		8,000	1/8	—		
		250	2	I_k=0.65 ma., no sig. (50 V.)		3,000	1/8	—		
		100	1.8	I_k=0.183 ma., no sig. (30 V.)		10,000	1/8	—		
		100	1.2	I_k=0.063 ma., no sig. (12 V.)		18,000	1/8	—		

PLUG-IN & BALLAST RESISTOR DATA, AND RMA DESIGNATION CODE

CONSIDERABLE confusion was caused by loose usage of the terms "ballast tube" and "ballast resistor" in the specifications and circuit diagrams of receiver manufacturers up to a few years ago. This has now been straightened out by the RMA, but service men should observe caution regarding these terms when referring to the servicing instructions and circuit diagrams of many of the older receivers.

Meaning of the term "Ballast Tube"

Ballast tubes (glass or metal-enveloped plug-in tubes containing a ballast resistor) have been employed mainly in battery-powered receivers, dc receivers and some ac-dc receivers. They are constructed to have the special operating characteristic of greatly decreasing their resistance if the current flow through them tends to decrease. Therefore, when they are connected in series with battery-powered vacuum tube filaments they maintain substantially constant current flow over a considerable range of battery voltage variation. They really act as *current regulators,* compensating, in part, for the gradual drop in battery voltage which accompanies increase in battery service hours. This "current regulating" feature of ballast tubes is what distinguishes them from the simple plug-in "voltage-dropping" resistors to be described later.

Commercial Ballast Tubes

The ballast tubes for use in battery-operated receivers are designed to permit the operation of 2-volt receiver type tubes from a 3-volt battery source which may consist of several banks of dry cells in parallel (the two individual cells of each bank being connected in series). The supply voltage varies from about 3.4 volts to 2.2 volts during the useful life of such groups of batteries. For this range of supply voltage the ballast tube types listed in the accompanying chart will maintain the tube socket terminal voltage between the limits of about 1.8 and 2.2 volts. Therefore, by their use, the tube filament voltage remains very close to the rated value of 2.0 volts during the major portion of the useful battery life.

Ballast tubes are rated according to the total filament current load they are connected in series with in the battery-operated receivers. To determine the total filament current load in series with the ballast tube, it is necessary to include the total filament current drain of the receiver tubes plus the current drain of the dial light if one is employed. For example, a receiver using a type 19, a type 30, and three type 34 tubes has a normal total filament current drain of 500 milliamperes. The correct ballast tube would be a type 1A1 (see table below).

BALLAST TUBE CHARACTERISTICS

Type No.	*Type of Receiver Used In*	*Ma. Load Current*	*Average Voltage Drop**	*Bulb Style*	*Base (RMA Standard—See Diagrams Below)*
1A1/5E1	Battery	500	1.0	ST-12	4-A
1B1	Battery	360	1.0	ST-12	4-A
1C1	Battery	745	1.0	ST-12	4-A
1D1	Battery	240	1.0	ST-12	4-A
1E1	Battery	480	1.0	ST-12	4-A
1F1	Battery	720	1.0	ST-12	4-A
1G1	Battery	420	1.0	ST-12	4-A
1J1	Battery	620	1.0	ST-12	4-A
1K1	Battery	550	1.0	ST-12	4-A
1R1G	Battery	540	1.0	ST-12	4-T
1T1G	Battery	560	1.0	ST-12	4-T
1X1	Battery	780	1.0	ST-12	4-A
1Y1	Battery	540	1.0	ST-12	4-A
1Z1	Battery	900	1.0	ST-12	4-A
2	DC, or AC-DC	300	9.0	S-14	4-A
3	DC, or AC-DC	300	128.0	ST-16	4-A
4	DC, or AC-DC	400	115.0	ST-16	4-A
5	DC, or AC-DC	460	115.0	ST-16	4-A
6	Battery	685	1.0	ST-12	4-A
7	DC, or AC-DC	300	176.0	ST-16	4-A
8	DC, or AC-DC	300	132.0	ST-16	4-A
9	DC, or AC-DC	300	50.0	ST-16	4-A
46A1	DC, or AC-DC	400	46.1	ST-12	5-7
46B1	DC, or AC-DC	300	46.1	ST-12	5-7

*This voltage drop is for average operation and may vary according to the supply voltage.

THE 3 DIFFERENT BASING ARRANGEMENTS USED IN BALLAST TUBES

Early forms of Filament Circuit Voltage-Dropping Resistors

In early ac-dc radio receivers, a voltage-dropping resistor (consisting of a wire-wound type of resistor mounted in a convenient position under the chassis) was employed for reducing the line voltage to the value needed for the series filament system. However, because of the

poor ventilation conditions existing under the set chassis, most of the heat developed in this resistor was communicated directly to the chassis and surrounding parts such as condensers, coils, etc. Because of the objectionable temperature rise which this caused, this under-chassis mounting proved unsatisfactory.

The next step was to incorporate this voltage-dropping resistor as a third wire on the attachment cord leading to the set. This put the heat-producing resistor outside of the set chassis, and provided better radiation for dissipating the heat. However, several objections to these cords also developed. In the case of a break or other trouble in the resistance element, access to it was usually rather inconvenient and the entire cord had to be unsoldered from the set, and a new one soldered into place for replacement. Then too, if the cord became rolled up or tangled, dangerous temperatures often developed due to the concentration of the heat in a small space. Furthermore there was always the danger of fire hazard which this heated line cord introduced into the home.

Development of Plug-In Voltage Dropping Resistors

The next step was to mount the voltage-dropping resistor elements on ordinary tube bases and surround them with a perforated cylindrical metal casing for heat conduction and radiation. Some were also built into glass bulbs similar to those of ordinary receiver tubes. This new type of construction made it possible to mount the resistor *on top* of the chassis where the heat can be gotten rid of more easily without damaging other vital parts in the receiver. It removed all high temperatures from the line cord and therefore reduced the fire hazard. The resistors were easily accessible for test and replacement, and in case of breakdown the plug-in feature made replacement a simple matter. Furthermore, with all connections made to the socket prongs *under* the chassis, no "hot" leads or high-voltage contacts are exposed.

When metal radio tubes were introduced, the straight sided metal tube envelope was immediately pressed into service for use on these resistors, and it is now used almost universally for them. This makes a convenient, compact, easily replaceable unit, and the metal envelope is an excellent heat radiator. A standard octal tube base is usually employed, with as many prongs as are necessary for making the required connections to the coiled-wire resistance element inside.

Supplying Pilot Light Voltages

In present-day ac-dc receivers, these units are designed to function not only as voltage-dropping resistors for the filament supply, but also as voltage dividers for supplying current to the various dial lamps in the receiver as well. It is this voltage-divider service that has caused the development of such a large number of different circuit arrangements and resistor values, for with some ac-dc receivers employing two or three dial lamps, quite a number of different circuit combinations and values are possible. Furthermore, in some units, "ballast" action is provided for in the dial light section.

Difference Between "Ballast Tubes" and Ordinary "Plug-In Voltage-Dropping Resistors"

The difference between *ballast tubes* and ordinary plug-in voltage-dropping resistors should be understood at this point. The design of the former is such that it not only acts as a voltage-dropping device but also provides current *regulation*. The latter type of voltage-dropping resistor is not intended especially to provide current or voltage regulation (except when this feature is incorporated in the dial lamp section). It is merely a simple voltage-dropping resistor mounted in a perforated metal enclosure and provided with a plug-in base for convenience in testing and replacing.

Confusion Caused by Non-Standard Design of Plug-In Resistors

The introduction of the present plug-in form of voltage-dropping and ballast resistors as the logical successors in set design for the old type "line-cords", resulted in the adoption of a shortsighted policy by some set manufacturers in attempts to get all the replacement business on their own ballasts. This consisted of each manufacturer making his unit just a little different from that of his competitor. Some used standard 4-prong bases, others used octal bases. In some cases the units were even purposely designed so that if a replacement unit other than that of the set manufacturer was used, the dial light resistor would be placed across 110 volts (or a similar high voltage) and burn out. No standard system of numbering was used. As a result of this period of non-standardization, many of the older receivers now in service contain plug-in voltage-dropping and ballast resistors which were made according to several different codes. For the guidance of service men who are called upon to service such receivers, many of these various codes which were employed in the past will be described later in this section.

The RMA Standard Plug-in Resistor Designation Code

In an effort to alleviate this chaotic state of affairs, the RMA sub-committee on plug-in and ballast resistors has attempted to standardize the circuit arrangement, ratings and designations of these units. First of all, it has been possible to reduce the number of circuit arrangements employed in these resistors so that present design practice has practically become standardized on about 11 different arrangements (see the circuits labeled *A, B, C* etc. ,in Fig. 17-2).

The RMA system for designation of type numbers consists of three main parts and a possible supplementary prefix letter and suffix letter. These are:

First: a "letter" (or letters) designating the type and current rating of the pilot lamp (or lamps) and the line current the unit is designed to be used with.

Second: a "series of digits" indicative of the overall voltage drop across the entire resistor system comprising the unit (including the pilot lamp, or lamps) when 300 milliamperes (0.3 amp.) flows through it.

Third: a "letter" indicating the circuit arrangement of the resistor elements comprising the unit and the base pins of the unit (see Fig. 17-2 for several popular circuit arrangements employed).

Fourth: if the unit provides ballast action on the dial lamp section, the prefix letter "B" is used at the extreme left.

Fifth: if the unit is of the octal-based *glass* type, a suffix letter "G" is placed at the extreme right. No suffix is used when the unit is of all-metal construction.

The illustration in Fig. 17-1 summarizes all these provisions of the RMA code pictorially, and should be studied carefully at this point.

Determining The "Dial Lamp" Code Letter

As mentioned, the type of dial lamps to be used with the resistor affect the code or type number of the unit. Three different kinds of dial lamps are used widely at the present time. These are the No. 40, 46, and 50 or 51 (see table in *Section 33* of this book). The distinguishing letters assigned to these lamps for the purposes of this code are as follows:

Designating Code Letter	*Pilot or Dial Lamp*
K	Mazda No. 40 (rated at 6.3 volts and 150 ma. and has a *brown* bead)
L	Mazda No. 46 (rated at 6.3 volts and 250 ma. and has a *blue* bead)
M	Mazda No. 50 or 51 (rated a 6-8 volts and 200 ma. and has a *white* bead)

*See *Dial Lamp Characteristic Table* in *Section 33* of this Handbook.

Hence, the Code letter which indicates the type of dial lamp will be K, L, or M, depending upon which of these three types of lamps is being used. Furthermore, this dial lamp designating letter will be preceded by the letter "B" if the unit provides ballast action for the dial lamp section.

Determining the "Voltage Drop" Code Number

Of course plug-in resistors are made in various resistance values according to the voltage drop that is to be produced. This required voltage drop depends, of course, upon the tube arrangement that is used. It is important to note that the plug-in resistors are rated according to the *voltage drop* and not the resistance value. In all cases, it is assumed that the resistor is for series operation of 300 milliampere (0.3 ampere) heater tubes, that is, the resistor will produce the required voltage drop when 300 milliamperes flows through it.

The standard method for designating the *second* portion of the type or code number, is to assign to it the

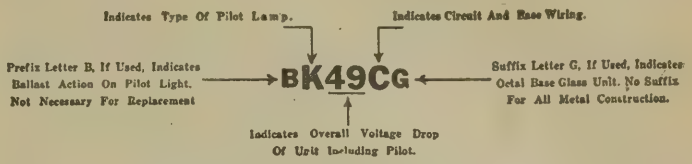

Indicates Type Of Pilot Lamp.
Indicates Circuit And Base Wiring.
Prefix Letter B, If Used, Indicates Ballast Action On Pilot Light. Not Necessary For Replacement
BK49CG
Suffix Letter G, If Used, Indicates Octal Base Glass Unit. No Suffix For All Metal Construction.
Indicates Overall Voltage Drop Of Unit Including Pilot.

FIG. 17-1.—Summary of the RMA Code for Plug-in resistor Type Number designation.

nearest integral number to the value of the voltage drop across the entire resistors unit (see Fig. 17-1) and in steps of approximately 6.3 volts, such as 17, 23, 30, 36, 42, 49, 55, 61, 67, 73, 80, 86 and 92 volts. (The *entire* resistor unit is considered as comprising the main resistor section and the dial lamps or other section or sections connected to the appropriate dial lamps or loads.)

About seven values of voltage drop have become most common as they fit in with most present day applications of the resistors in ac-dc receivers. These seven values, and the tube complement for which each is adapted, are listed below. A 117-volt power supply is assumed for each:

Voltage Drop	*Tube Complement*
90	1—25 volt tube
80	2—6.3 volt and 1—25 volt tubes
55	2—6.3 volt and 2—25 volt tubes
49	3—6.3 volt and 2—25 volt tubes
42	4—6.3 volt and 2—25 volt tubes
36	5—6.3 volt and 2—25 volt tubes
23	3—6.3 volt and 3—25 volt tubes

For example, in a 5-tube ac-dc receiver employing two type 78 tubes, a 75, a 43 and a 25Z5 rectifier, a 49-volt ballast resistor would be needed. The second portion of the Type Code number on this resistor would be, of course, *49*.

Determining the "Circuit Arrangement" Code Letter

The standard method for designating the *third* section of the type or code number, is to assign to it a *letter* which indicates the circuit arrangement of the resistor elements comprising the unit and the connections to the base pins. Present practice has practically standardized on about 11 different circuit arrangements, as shown in Fig. 17-2. These circuits are labeled *A, B, C,* etc., in accordance with the *RMA Plug-In Resistor Code.* The small numbers at the terminals of each circuit refer to the numbers of the base pins to which these terminals of the resistor are brought out. The correct base pin numbers are specified for the various types of bases which may be employed in the unit (4-pin base, octal base, etc.), and are in accordance with the standard RMA base-pin designation system (see *Section 21* in this

Handbook). For reference purposes, the *bottom* views of both a standard 4-pin *UX* tube base and an *Octal* base (with the base pins properly numbered) has also been included at the bottom of Fig. 17-2.

For example, the arrangement shown in circuit *A* is that of a voltage-dropping resistor composed of a simple untapped resistor unit. The ends are brought out to base pins No. *3* and No. *7* if an octal base is used—or to pins No. *1* and No. *4* if a 4-pin base is used.

The arrangement shown in circuit *B* is that of a voltage-dropping resistor which is tapped at a suitable point for supplying the proper voltage to the single dial lamp shown. The end terminals are brought out to base pins No. *3* and No. *7* if an octal base is used—or to pins No.

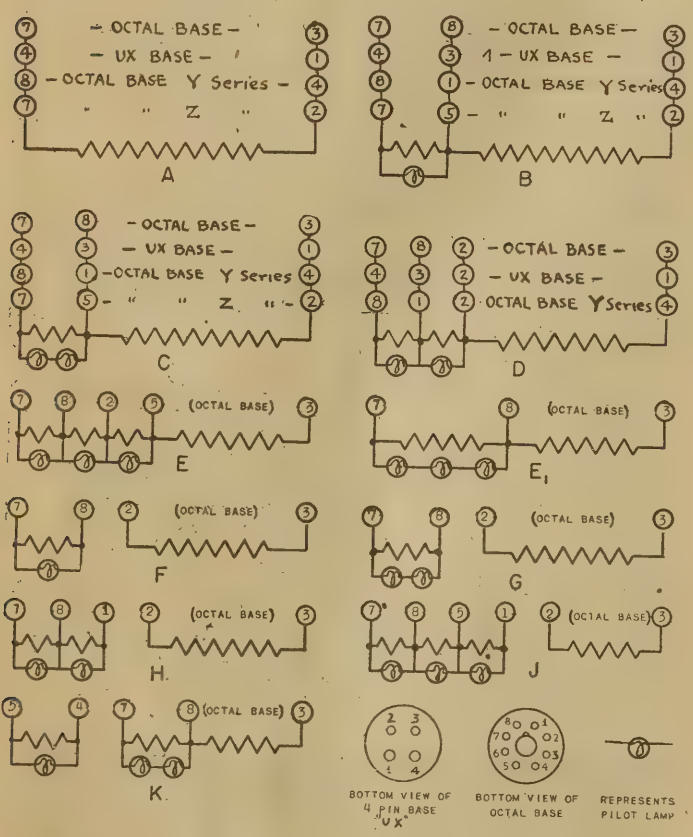


Fig. 17-2.—Standard Circuit arrangements (with their base wiring connections, and RMA base-pin numbers) employed in plug-in resistors. At the lower right are shown the bottom views of both a standard 4-pin *UX* tube base and an *Octal* base (with the base-pins properly numbered) for reference purposes.

1 and No. *4* if a 4-pin base is used. The tap is brought out to pin No. *8* on an octal base, or to pin No. *3* on a 4-pin base. The dial lamp should be connected between the left end of the resistor and the tap, as shown.

In the arrangement shown in circuit *C* the resistor is also tapped at one point, but the tap is positioned so that the necessary voltage for two dial lamps in series is provided. The two dial lamps are connected as shown.

In circuit *D* the resistor is tapped at two points so that two dial lamps can be supplied individually.

Circuit *E* is arranged for supplying three dial lamps individually. Circuit *E-1* is arranged for supplying the three lamps in series.

In discontinuous units (*F* to *J*), the resistor is composed of two separate sections. The high-drop section terminates on pins Nos. *2* and *3*, while the low-drop section which feeds the dial lamps terminates on pins Nos. *7* and *8*, or *7* and *1*.

In unit *K* the resistor is also composed of two separate sections. The high-drop section terminates at pins No. *3* and *8*. One dial light section terminates at pins No. *4* and *5* of the octal base.

When it is necessary to ground the shell of metal-enclosed units, pin No. *1* is used for connection to the shell, except in the case of circuits *H* and *J* in which pin No. *4* is used for the purpose, if possible. In general, however, pin No. *4* is used for connection of a jumper between it and pin No. *3* in the interest of providing for use of alternate resistor units with a given receiver for either 110-volt or 220-volt operation.

The Suffix Letter for Designating a "Glass" Envelope

When the unit is enclosed in a glass housing, this is indicated in the designation by the addition of the letter "*G*" as a suffix (see Fig. 17-1), as in vacuum tube designation practice. If the unit is of all-metal construction, this suffix does not appear.

Units Having 4-Pin Bases

When the unit is equipped with a 4-pin base, this is indicated by the insertion of the letter "*X*" between the dial light designating letter and the voltage-drop rating numeral, thus, *MX61E1*.

When Dial Lamps Are to be Operated at Other Than Standard Voltage

Since the standardization assumes that the dial lamp sections of the resistor unit are designed to operate the dial lamps at their definite rated voltage, whenever special provision is made to operate them at some other voltage this is indicated in the designation by the insertion (between the voltage rating numeral of the entire unit and the circuit arrangement designating letter) of a second series of digits set off by hyphens expressing the *mean* dial lamp voltage to the nearest tenth of a volt.

Summary of RMA Designation Code for Plug-in Resistors

From what has been said, it is evident that in designating a plug-in type resistor for a certain receiver, *three* components are necessary in the Code or Type No. The *first* is the letter *K*, *L*, or *M* indicating the type of dial

lamp used. The *second* is the number indicating the voltage drop, and the *third* is the letter from *A* to *J* indicating the internal circuit arrangement within the plug-in resistor. If it carries a prefix *"B"*, it indicates that there is ballast action in the dial lamp section. If the letter *"G"* follows the code number, it indicates that the unit is of the octal-base glass type—otherwise it is of the metal-tube type.

It is evident that the letter *A, B, C,* etc., following the center code numerals in a voltage-dropping resistor tube number always indicates which of these circuit arrangements is used. Hence it is a simple matter for the service man to check such a resistor by noting from the code number which circuit is used and then checking with an ohmmeter or other continuity tester across the terminal pins to which the connections are brought out.

Caution should be observed when dealing with any types bearing the *"E"* circuit designation, since both circuit *"E"* and circuit *"E_1"* have been used in some units under the plain "E" classification. An ohmmeter check between the various pins will reveal the exact circuit arrangement used in any such unit.

Examples of Standard RMA Designation Code Markings for Plug-In Resistors

By way of example of the actual working of the RMA Designation Code which has just been described in detail, if a plug-in resistor bears the Code or Type No. *L36B,* it is at once known that it is for use in a receiver employing one No. 46 (*blue* bead) dial light, that a 36-volt drop occurs in the resistor (suitable for a seven-tube receiver employing five 6.3-volt tubes and two 25-volt tubes), and that the circuit arrangement is as shown at *B* in Fig. 17-2. Furthermore the unit is of the all-metal type with an octal base.

A unit bearing the number *LX36B* would be for use with the same type of receiver as the one in the last example but the letter *"X"* would indicate that this unit employs a 4-pin socket.

A unit bearing the number *K55D* is for use with a receiver employing two No. 40 (*brown* bead) dial lights, a 55-volt drop occurs in the resistor (suitable for a four-tube receiver employing two 6.3-volt tubes and two 25-volt tubes), and the circuit arrangement is shown at *D* in Fig. 17-2.

Non-standard Designation Codes which have been used on Plug-in Resistors in the past

Although the foregoing RMA standard numbering system is now being observed quite generally by manufacturers, a number of different codes have been used in the past. As there are thousands of both "standard" and "orphan" radio sets now in use which contain these plug-in resistors, it is well for the service man to acquaint himself with the particular numbering systems and circuit arrangements which were used most widely in these resistors. Some of these will now be described. Of course in those sets with special wiring, special replacement plug-in resistor units are required—a standard unit cannot generally be used without rewiring.

With glass tube 4-prong base plug-in resistors a much used system was to use a *number* to indicate the overall resistance and a *letter* to tell the type of pilot lamp used. The number 4 followed to indicate a 4-prong base. For example, 165L4 meant a 4-pin glass ballast resistor having a value of 165 ohms with a type L (No. 46) pilot lamp connected across terminals 3 and 4.

To convert this code to the present standard system, it is only necessary to multiply the resistance by 0.3 to get the voltage drop (E equals I x R), that is, 165 x 0.3 equals 49.5. The standard octal unit would then be an L49B, which could be used by replacing the 4-pin socket with an octal socket and connecting the pilot lamp across terminals 7 and 8.

With another group of resistors, an X is used after the pilot lamp letter to indicate a 4-prong base, as KX49B. This designates a 49-volt drop and the use of a No. 40 pilot lamp. This group of resistors is interchangeable with the 4-prong series described above. It is only necessary to divide the voltage drop (49 in this case) by 0.3 to get the resistance value. Thus, 49 divided by 0.3 is 163.3 (approximately 165 ohms) and hence the corresponding replacement number would be 165R4. The pilot lamp with the ballast resistor shunted across it is connected across terminals 3 and 4. Also, as was explained previously, a standard octal base replacement resistor can be used by changing the socket to an octal base.

A third group of ballast resistors has a Y after the pilot lamp letter. This Y indicates that although the resistor has an octal base, no standard pin wiring arrangement is followed. If such a resistor must be replaced, it is best to use a standard octal base unit and change the socket wiring accordingly.

A fourth group of resistors carries the letter Z after the pilot lamp letter. In these also no standard pin wiring arrangement is used; and when replacement is necessary, a standard octal base resistor is recommended. The socket wiring, of course, must be changed to agree with the resistor wiring. For example, a KZ42C would be replaced with a K42C and the socket wiring changed to standard practice.

Another octal-base group called the S1 series, is similar to the Z series just described, but has an additional 50 ohms connected between pins 7 and 3 to limit the plate current of the 25Z5 rectifier in case of short circuit. For example, the code number of a resistor is L55S1. This uses a No. 46 pilot lamp in a standard B circuit, and a 55-volt drop occurs within the resistor. If the letters S2 or S3 follow the pilot lamp letter, this indicates the use of 2 or 3 pilot lamps connected in series in a standard C circuit. In case of failure an exact duplicate replacement resistor should be used, or a standard unit inserted and the wiring changed to standard practice without the 50 ohm resistor in series with the 25Z5 plate.

In the P series of ballast resistance, K55BP, standard octal base wiring is used with an extra 50-ohm limiting resistor connected between pins 7 and 5 in series with the 25Z5 plate. If replacement is necessary, a standard unit should be used, and a short-circuiting jumper wired across pins 7 and 5.

Still another series of octal base ballast resistors use the standard wiring and standard numbering system, but have the letter J follow the resistor number, as K49BJ. In these resistors a jumper is connected across pins 3 and 4, and the line current of the set is caused to flow through this jumper. The purpose of this arrangement is to provided space for an additional ballast resistor in case it is desired to operate the set on a higher line voltage than 115 volts, (such as 230 volts). If it is necessary to replace such a J

type resistor in a set operating on a 115-volt line, a standard unit can be used (K49B in the example), and an external jumper wired across terminals 3 and 4 on the socket. If the set works on a higher voltage line, then an exact duplicate J-type replacement unit must be used.

Thousands of orphan radio sets have been sold using an outlawed octal socket having only four or five of the eight holes punched out. This prevents a standard replacement ballast from being used, even though electrically it may be the correct replacement.

Use Caution when using "Universal" Plug-in Resistors

A word of caution to service men when using "universal" type plug-in resistor replacement units will not be amiss here. In order to save the added cost of terminal strips, some manufacturers of a.c.-d.c. sets have been using the extra socket connections of the resistor tube for tie-in posts. These tie-ins, in most instances, carry plus B voltage. This practice has resulted in much grief by way of quick burnouts of tube-type resistors, and even serious damage to the set itself.

Therefore, the socket connections should be checked before inserting a "universal" type resistor tube. If only three prongs are needed, cut off the extra prongs so as to avoid any danger of having one of these extra prongs make contact with any high-voltage source that might burn out the tube.

Specifically: Take the 10-23-A as an example. It comes with connections at prongs Nos. 7, 8, 2 and 3. Should there be any connection at the socket for any other voltage but the line voltage, be sure to cut off the extra prongs. For example, we are going to replace a K55-B resistor unit with a 23-55-A Universal resistor unit. On the K-55-B we have prongs Nos. 7, 8 and 3 for the necessary drop, while the 23-55-A has a connection at No. 2 prong also. Therefore, cut this No. 2 prong off to be safe, for under the chassis the set manufacturer may be using socket connection No. 2 for tying in some source of high voltage.

RECEIVING TUBE CLASSIFICATION CHART — CLASSIFICATIONS BY "INTERNAL STRUCTURE," BY "USE" OF TUBE AND BY "CATHODE VOLTAGE"

*Tube Classification by "Internal Structure"**

Radio tubes may be classified according to the number of elements or electrodes they contain. Thus:

A DIODE is the simplest form of tube and contains two elements, a cathode and a plate. Types 81 and 12Z3 are examples of this class.

A TRIODE or three element tube, contains a cathode, a grid and a plate, as for example, types 27 and 2A3.

A TETRODE is a four element tube having a cathode, two grids and a plate. The name *SCREEN GRID TUBE* is sometimes used for a tetrode, such as the type 24A, in which the outer grid is operated as a screen grid. One type of tetrode is a *BEAM POWER TUBE* in which the electrodes are so spaced that the electron stream is confined to relatively narrow paths, or beams, and sufficient space charge is built up between the screen grid and the plate to prevent any appreciable flow of secondary electrons between them. The electron beams are produced by the use of aligned grids and deflector plates partially surrounding the screen grid support rods and connected electrically to the cathode. The 6L6 and 6V6G are beam power tubes.

A PENTODE is a five element tube which contains a cathode, three grids and a plate, types 78 and 42, for example.

A HEXODE is a six element tube containing a cathode, a plate and four other electrodes.

A HEPTODE is a seven element tube having a cathode, a plate and five other electrodes, usually grids. PENTAGRID is another term applied to this type of tube. Types 6A7 and 6L7 are in this classification.

A MULTIPLE UNIT TUBE is one containing two or more sets of electrodes, or units, in the same envelope. In some types a single cathode, common to both units, is used; in others separate cathodes are used. Each unit can usually be operated as if it were a separate tube in its own envelope. A two-unit tube is often referred to as a DUO- or DUPLEX-TUBE.

A DUO-DIODE is a duplex tube containing two diode units, as a type 6H6.

A DUO-DIODE TRIODE is a duplex tube containing a duo-diode unit and a triode unit, as a type 75.

A DUO-DIODE PENTODE is a duplex tube containing a duo-diode unit and a pentode unit, as a type 6B7.

A DIODE-PENTODE is a duplex tube containing a diode unit and a pentode unit, as a type 12A7 or a 25A7G.

A TRIODE-PENTODE is a duplex tube containing a triode unit, and a pentode unit, as a type 6F7.

A TRIODE-HEPTODE is a duplex tube containing a triode unit and a heptode unit.

A TWIN TUBE is a duplex tube containing duplicate units, types 6A6, 1E7G, and 12SN7-GT for example.

A DIODE-TRIODE-PENTODE is a duplex tube containing a diode unit, a triode unit and a pentode unit (types 3A8GT and 1D8GT are examples).

*Tube Classification by "Function" or "Use"**

Tubes may be further classified according to their uses or functions in a circuit. Thus:

A RECTIFIER TUBE (usually a diode or a twin diode) is one used inobtaining a directcurrentorvoltage from an alternating current supply.

A HALF-WAVE RECTIFIER TUBE is one used in a half-wave rectifier circuit and in which curent flows only during alternate half-cycles of the a-c supply voltage. A half-wave rectifier tube is usually a diode such as a type 81 or a 12Z3. However, a triode like the type 37 or other multi-electrode tube may be used by connecting the grid or grids to the plate to form a diode.

A FULL-WAVE RECTIFIER TUBE is a twin diode used in a full-wave rectifier that current flows through one diode during one half-cycle and through the other diode on the alternate half-cycle of the a-c supply voltage. Two separate diodes may be used instead of a twin diode in a full-wave circuit.

A VOLTAGE DOUBLER TUBE is a twin diode tube having separate cathodes insulated from each other so that the two sections may be connected in series in a voltage doubler circuit. Although a twin diode tube is usually used in this circuit, two separate diodes may be used to accomplish the same result.

AN AMPLIFIER TUBE is one used to amplify a voltage applied by the input circuit between two electrodes, a control grid and the cathode. An amplified

---

**Courtesy Raytheon Production Corp.*

voltage appears in the output circuit, usually the plate circuit and a portion of this voltage is developed across the load impedance.

A VOLTAGE AMPLIFIER TUBE is an amplifier tube used to supply an amplified voltage to another tube which may be another voltage amplifier tube, a power amplifier tube or a detector tube.

A POWER AMPLIFIER TUBE is an amplifier tube used to develop a relatively large amount of power, as contrasted to voltage, in the output circuit and may be a triode, a tetrode, or a pentode.

A REMOTE CUTOFF AMPLIFIER TUBE is one that requires a relatively high negative bias on the control grid to reduce the plate current and transconductance to zero or to very low values. Relatively large signal voltages may be applied to tubes of this class without producing serious cross modulation or modulation distortion. Most remote cutoff tubes are made with a variable-mu control grid.

A DETECTOR TUBE is one used to separate the low-frequency component of a modulated signal from the high-frequency carrier of radio or intermediate frequency. Various types of tubes, diodes, triodes, tetrodes and pentodes may be employed as detectors.

AN OSCILLATOR TUBE is an amplifier tube operated in a suitable circuit to produce a-c power when supplied with d-c power. Triodes such as types 76 and 6J5G, are commonly used as oscillators in superheterodyne receivers.

A MIXER TUBE is one in which two applied voltages of different frequency are combined, or mixed, to produce beat frequency voltages which are equal to the sum and difference of the applied frequencies, in the output circuit.

A CONVERTER TUBE is a special form of mixer tube in which one of the two combining voltages is produced by self-oscillations in the tube itself. The 6A7 is one of the tubes designed specially for converter service but other multi-grid types, such as the type 77, have been used.

AN ELECTRON RAY TUNING INDICATOR TUBE is a tube in which an electron beam causes a luminous area to appear on a fluorescent screen, or target. The shape and size of this luminous area vary in accordance with the voltage applied to the control grid of the tube, giving a visual indication of the changes in the control grid voltage. Usually this tube is a duotriode, one section functioning as a d-c amplifier and supplying an amplified d-c voltage to the control electrode of the target section. The 6E5 is an example of a tuning indicator tube.

A classification of all modern receiving tube types according to their "use", or "functions," and their "cathode voltages" is presented in chart form for convenience on the next two pages.

SEE
TUBE CLASSIFICATION CHART
ON NEXT TWO PAGES

RECEIVING TUBE CLASSIFICATION CHART*

The following chart classifies receiving tubes accordnig to their "use," or "functions," and their "cathode voltages." It will assist the service man in identifying type numbers and in choosing a tube type for an application. Types having similar characteristics are grouped in parentheses.

Cathode Volts	1.4	2.0	2.5 to 5.0	6.3	12.6 to 117
DIODE DETECTORS & RECTIFIERS					
Detectors — single	1A3				
Detectors — twin				(6H6, 6H6-GT/G), 7A6	12H6
Rectifiers — half-wave				1-v	12Z3, 35Z3, 35Z4-GT, 35Z5-GT/G, 45Z3, 45Z5-GT
Rectifiers — half-wave, with beam power amplifier					32L7-GT, 70L7-GT, 117L/M7-GT, 117N7-GT, 117P7-GT
Rectifiers — half-wave, with power pentode					12A7 25A7-GT/G
Rectifiers — full-wave — vacuum			(5T4, 5U4-G, 5X4-G, 5Z3), (5W4, 5W4-GT/G, 5Y3-GT/G, 5Z4, 5Y4-G, 80), (5V4-G, 83-v)	(6X5, 6X5-GT/G, 84), 6Y5, 6Z5, 6ZY5-G, 7Y4	
Rectifiers — full-wave — mercury			82, 83		
Rectifiers — full-wave — gas	Cold-Cathode Types: 0Z4, 0Z4-G.				
Rectifier-Doublers					(25Z6, 25Z6-GT/G, 25Z5, 25Y5), 50Y6-GT/G, 50Z7-G, 117Z6-GT/G
DIODE DETECTORS with AMPLIFIERS					
One Diode — with high-mu triode	(1H5-G, 1H5-GT), 1LH4				
One Diode — with high-mu triode, r-f pentode	3A8-GT*				
One Diode — with medium-mu triode, power pentode	1D8-GT				
One Diode — with pentode	1S5				
One Diode — with power pentode	1N6-G				
Two Diodes — with medium mu-triode		(1B5, 1H6-G)	55	(6SR7, 6R7, 6R7-G, 6R7-GT, 6ST7, 6V7-G, 85), 6C7, 7E6	12SR7
Two Diodes — with high-mu triode			2A6	(6SQ7, 6SQ7-GT/G, 6Q7, 6Q7-G, 6Q7-GT, 6B6-G, 6T7-G, 75), 7B6, 7C6	(12SQ7, 12SQ7-GT/G, 12Q7-GT)
Two Diodes — with pentode		(1F7-G, 1F6)	2B7	(6B8, 6B8-G, 6B7, 6B7-S), 6SF7, 7E7	12C8, 12SF7
CONVERTERS & MIXERS					
Pentagrid Converters	(1A7-G, 1A7-GT), 1R5, 1B7-GT, 1LA6	(1C7-G, 1C6), (1D7-G, 1A6)	2A7	(6SA7, 6SA7-GT/G, 6A8, 6A8-G, 6A8-GT, 6D8-G, 6A7, 6A7S), 7B8, 7Q7	(12SA7, 12SA7-GT/G, 12A8-GT)
Triode-Hexode Converters				(6K8, 6K8-G, 6K8-GT),	12K8
Triode-Heptode Converters				6J8-G, 7J7	
Octode Converters				7A8	
Pentagrid Mixers				(6L7, 6L7-G)	

Courtesy Radio Corp. of America—RCA Victor Division.

—Cont'd

—Cont'd

Cathode Volts	1.4	2.0	2.5 to 5.0	6.3	12.6 to 117
VOLTAGE AMPLIFIERS, DETECTORS, OSCILLATORS					
Triodes — medium-mu — single unit	1G4-GT/G	(1H4-G, 30)	27, 56, 485	(6C5, 6C5-GT/G), (6J5, 6J5-GT/G, 7A4), (6P5-GT/G, 76), 6L5-G, 6AE5-GT/G, 37	12J5-GT
Triodes — medium-mu — twin unit	3A5*			6C8-G, 6F8-G, 6J6, 6SN7-GT	12AH7-GT, 12SN7-GT
Triodes — medium-mu — twin plate				6AE6-G	
Triodes — medium-mu — twin input				6AE7-GT	
Triodes — medium-mu — with power pentode				6AD7-G	
Triodes — medium-mu — with diode, power pentode	1D8-GT				
Triodes — high-mu — single unit				6SF5, 6SF5-GT, 6F5, 6F5-G, 6F5-GT), 6K5-G, 7B4	(12SF5, 12SF5-GT, 12F5-GT)
Triodes — high-mu — twin unit				(6SC7, 7F7), 6SL7-GT	12SC7, 12SL7-GT
Triodes — high-mu — with diode, r-f pentode	3A8-GT*				
Tetrodes — remote cut-off		1D5-GT	35		
Tetrodes — sharp cut-off		32	24-A	36	
Pentodes — remote cut-off	1T4, 1P5-GT	(1D5-GP, 1A4-P), 34	58	6SS7, (6SK7, 6SK7-GT/G, 6K7, 6K7-G, 6K7-GT, 78), (6S7, 6S7-G), (6U7-G, 6D6, 6E7), 6W7-G, 39/44, 7A7, 6AB7, 6AC7, 7H7, 7B7	(12SK7, 12SK7-GT, 12K7-GT), 14A7/12B7
Pentodes — remote cut-off, with triode				6F7, 6P7-G	12B8-GT, 25B8-GT
Pentodes — semi-remote cut-off				6SG7	12SG7
Pentodes — sharp cut-off	(1N5-G, 1N5-GT), 1L4, 1LN5	(1E5-GP, 1B4-P), 15	57	6AG5, 6SH7, (6SJ7, 6SJ7-GT, 6J7, 6J7-G, 6J7-GT, 6D7), 77, 6C6, 7C7, 7G7/1232	12SH7, (12SJ7, 12SJ7-GT, 12J7-GT)
Pentodes — sharp cut-off, with diode, high-mu triode	3A8-GT*				
POWER AMPLIFIERS					
Triodes — low-mu — single unit		31	2A3, 45, 183/483	6A3, 6B4-G	
Triodes — low-mu — twin unit				6E6	
Triodes — high-mu — single unit		49	46	6AC5-GT/G, 6C4	25AC5-GT/G
Triodes — high-mu — twin unit	1G6-GT/G	(1J6-G, 19)	53	(6N7, 6N7-GT/G, 6A6), (6Y7-G, 79), 6Z7-G	
Beam Tubes — without rectifier	(1Q5-GT/G, 3Q5-GT/G*), 1T5-GT			(6L6, 6L6-G), (6V6, 6V6-GT/G), 6Y6-G, 7A5, 7C5	(25L6, 25L6-GT/G), 25C6-G, 35A5, 35L6-GT/G, 50L6-GT
Beam Tubes — with rectifier					32L7-GT, 70L7-GT, 117L/M7-GT, 117N7-GT, 117P7-GT
Pentodes — single unit	1A5-GT/G, (1S4, 3S4*), 1C5-GT/G, 1LA4, 1LB4, (3A4*, 3Q4*)	(1F5-G, 1F4), (1G5-G, 1J5-G), 33	2A5, 47, 59	(6F6, 6F6-G, 42), (6K6-GT/G, 41), 6G6-G, 38, 6A4, 89, 7B5	12A5, (25A6, 25A6-GT/G, 43), 25B6-G
Pentodes — twin unit		1E7-G★			
Pentodes — with diode & triode	1D8-GT				
Pentodes — with medium-mu triode				6AD7-G	
Pentodes — with rectifier					12A7, 25A7-GT/G
Pentodes — video				6AG7	
Direct-Coupled Amplifiers				6B5, 6N6-G	(25B5, 25N6-G)
ELECTRON-RAY TUBES					
Single — with remote cut-off triode				6AB5/6N5, 6U5/6G5	
Single — with sharp cut-off triode			2E5	6E5	
Twin, without triode				6AD6-G, 6AF6-G	
GAS-TRIODES			2A4-G		

★ Two 1F5-G's in one bulb.

* Filament arranged for either 1.4 volt or 2.8-volt operation.

NOTE: The above classification does not include the following old types: 00-A, 01-A, 10, 11, 12, 20, 22, 26, 40, 48, 50, 71-A, 81, 99, 112-A, 876, and 886. Data on these types, however, are given in subsequent pages.

NON-RMA "TYPE NUMBER" DESIGNATIONS FOR OLDER STANDARD NON-OCTAL BASED TUBES

PREVIOUS to the standardization of the RMA tube "type-number" designation system in 1933, the numbering of the various tube types bore no definite relation to any operating or construction characteristics of the tubes. The only exception to this was the practice of using a suffix letter *"S"* to indicate a spray-shielded tube, or one which came equipped with a separate tight-fitting metal shield.

However, some general groupings of these older tube type numbers can be made in terms of some of their operating characteristics, and it is convenient for the service man to remember these groups. For example:

5-Volt Filament Tubes	*2-Volt Filament Tubes*	*6.3-Volt Filament Tubes*
01	30	36
01A	31	37
01AA	32	38
01B	33	39
01C	34	41
		42
		44

2.5 Volt Filament Tubes	*6.3 Volt Filament Tubes*	*6.3 Volt Filament Tubes*
56	56	64
57	57	64A
58	58	65
and corresponding	and corresponding	65A
"S" types	"A" and "AS" types	67
		67A
		68
		68A
		75
		75S
		76
		77
		78
		79

Attention is called to the many obsolete and semi-obsolete tubes employing less than 8 pins (non-octals) shown on the *Receiving Tube Characteristics Chart* of *Section 22*. The column at the extreme right of this chart gives the present interchangeable replacement tube type number (if one is available). Also see Section *29* which explains how some receivers using older type tubes can be modernized by substituting suitable newer type tubes for them.

It should be understood that many of the non-octal tubes (the later ones) bear type numbers which were designated to them in accordance with the standard RMA type-number designation system explained in *Section 20*.

RMA "TYPE NUMBER" DESIGNATION SYSTEM FOR ALL OTHER STANDARD RECEIVING TUBE TYPES

(Some "Non-Octal" Tubes; All "Octal", "Lock-in", "Miniature", etc., Tubes)

THE RMA "type number" designation system (standardized in 1933) which is employed for designating the type numbers of all standard American receiving tubes (other than those already mentioned in *Section 19*) should be understood by every radio service man, for the type number itself gives considerable information regarding the construction and purpose of a tube.

With this system, only three or four symbols are required to give a tube an identifying type number. They are:

(1) a *first numeral* (or *group of numerals*)

(2) one or more distinguishing *letters.*

(3) a *last numeral*

(4) a *letter suffix*

The letter *suffixes* are not required for some tubes, as we shall see later (see the tube type numbers listed in the left-hand column of the various pages which comprise the *Receiving Tube Characteristics Chart in Section 22*).

Significance of the "First Numerals" in the Tube Type Number

The first *numeral* (or *first group of numerals*) indicates the approximate *filament* or *heater* operating voltage of the tube. In order to avoid the use of decimals in these numbers, the numeral actually used is always that of the *next lower "even" volt* (except in the case of the 2.0-volt filament tubes which are assigned the numeral "1" to differentiate them from the 2.5-volt filament tube types which necessarily are assigned the numeral "2"). For example, the numeral *1* is used for all voltages below 2.1, the numeral *2* is used for voltages between 2.1 and 2.9, the numeral *3* is used for voltages between 3 and 3.9, etc.

Thus, the numeral *1* is used for 2-volt tubes (like the 1A6) and the 1.4-volt tubes (like the 1LA4, 1LA6, etc.), the numeral *2* is used for the 2.5 volt tubes (like the 2A3), the numeral *5* is used for the 5-volt tubes (like the 5Z3), the numeral *6* is used for the 6.3-volt tubes (like the 6A6), the numeral *12* is used for the 12.6-volt tubes (like the 12A5), etc.

Many of the tubes with the lock-in type base can be recognized by their filament voltages; type numbers starting with the numeral 7 are those of lock-in tubes. Examples are the 7A6, 7A7, 7B7, 7C6, etc., tubes. There are some exceptions to this however, as in the cases of the 1201, 14A4, 35A5, 35Z3, 1231, 1232, etc., lock-in based tubes.

Significance of the Distinguishing "Letter" in the Tube Type Number

The *letter* (or *letters*) following the first numeral shows the *function* of the tube and distinguishes one tube type from another which may happen to have the same numerals. Thus, the *letter* in the "type number" is the only thing which distinguishes between the type numbers of the 1A6 and 1C6 tubes, etc. These letters are arbitrarily assigned in alphabetical sequence, starting with A, for all tubes except rectifiers. In the case of rectifiers, a separate assignment is made, starting with Z and working backward. The number of tube types manufactured has now become so large that *two* letters are employed in the type numbers of some tubes (see the Chart in *Section 22*). This departure from the conventional system is made in cases where it is found that the type number which would ordinarily be assigned to a new tube if *one* letter were to be used, has already been assigned previously to some existing tube being manufactured. In such cases *two* letters are used in the type number of the newer tube to distinguish it from the other one. Examples of this are furnished by the 6Z5 and 6ZY5G tubes, the 6B5 and 6AB5 tubes, etc.

Some metal tube types which were first introduced with a top control-grid cap are now also available with the control-grid brought out to another pin on the tube base instead. The balance of the tube base connections in such "single-ended" tubes may also be different, i.e., the various elements may terminate at different base pins than in the original type. To distinguish between these newer *"single-ended"* tubes and the corresponding "original types", their type letters consist of those of the equivalent double-ended tube with an *"S"* added before it (the S standing for "single-ended"). For example, the 6K7 and 6SK7 tubes, the 6F5 and 6SF5, etc.

The use of the letter "S" in this way to indicate "single-ended" construction should not be confused with the use of the letter "S" as a *suffix* to the tube type numbers of non-RMA type numbers such as the 56S,

57S, etc., (see *Section 19*) to indicate a metal spray-shielded tube. Generally, symbols containing two letters, the *first* of which is an S, indicate single-ended tubes with characteristics resembling the tube indicated by that symbol when the S is removed. In some cases the tubes are not exactly electrically equivalent, for example, the 6K7 is less efficient than the 6SK7 as an amplifier.

Significance of the "Last Numeral" in the Tube Type Number

The *last numeral* indicates the number of *useful* elements which are brought out to the terminals. Thus, the 2A5 has *five* such "useful" elements: a heater, a cathode, two grids and a plate. In this particular tube, the suppressor is not brought out to an external terminal (it is connected to the cathode *inside* of the tube) so it is not counted.

Significance of the "Letter Suffixes" in the Tube Type Number

With the introduction of the "glass" equivalents of "metal" tubes, the use of *letter suffixes* in the tube type numbers has become common. A number of such letter suffixes are now in use and they indicate some of the *mechanical* characteristics of the tube. The following list gives the various suffixes, and tells what each one denotes:

For Octal-Base Type Tubes:

Suffix:	*Denotes*:
M	— Metal envelope and octal base
G	— Glass envelope and octal base
GM	— Metal-coated glass envelope and octal base
GL	— Integral (T-9) Glass envelope and base (lock-in)

For Lock-in Base Type Tubes:

Suffix:	*Denotes*:
GL	— Integral (T-9) Glass envelope and base (loktal)
ML	— Integral (T-9) Metal envelope and base
LM	— (MT-8) Metal envelope and octalox base (lock-in)
LT	— (T9) Glass envelope and octalox base (lock-in)
GB	— Integral (T-5½) Glass envelope and base

For example, the suffix *"G"* indicates a glass tube with an octal base. Consequently the type No. 6X5G indicates a tube having the equivalent internal structure of a 6X5 metal tube but equipped with a *glass* envelope and an octal base (suffix *"G"*). As a general rule, the characteristics of a G-tube are the same as those of its metal equivalents (if such an equivalent tube exists), except for the inter-electrode capacitances and the shielding properties. The suffix *"GT"* indicates a short (T-9) glass envelope with an octal base. Thus, the type No. 6X5GT would be a tube having the same internal structure as the 6X5 metal tube, but mounted in a short (T-9) glass envelope with an octal base. A 6X5MG would be a tube having the same internal structure but a metal-glass envelope, etc.

Some of the G-tubes have been made with a smaller tubular glass envelope. These are known under various names, as "Bantam", "Dwarf Tubes", or "Tom Thumbs." Such tubes are indicated by a suffix *"T"* added after the *"G."* Their characteristics are similar to those of the corresponding G-tubes. Thus the 6K7, 6K7G and 6K7GT all represent tubes with the same characteristics, but the 6K7 is a *metal* tube, the 6K7G is a *glass* tube with *dome-shaped bulb* and *octal* base, the 6K7GT is a *glass* tube with a *tubular* bulb and the same *octal* base.

How to Deduce General Information about a Tube from its "Type Number"

If this RMA tube "type-designation" system is kept in mind, it is usually possible to figure out the main information about a tube from a study of its type number. For example, the 2A3 tube must have *three* "useful" elements brought out to terminals. The tube is certainly not a rectifier because it has the letter "A". It must therefore be a *triode*. Also, the last number does not allow for a heater in addition to the other three "useful" elements. Therefore it must be a *"direct-heater"* or a *"filament"* type tube. Considering these deductions together with the first numeral, we find that the tube must be a *2.5-volt filament-type triode*. Similarly, the tube type number 25Z5 tells by its first numerical group *25* that the filament or heater operates at approximately 25 volts; by the letter *Z* that the tube is a rectifier; and by the final number *5* that the tube has *five* connected elements, i.e., *two* plates, *two* cathodes and *one* common heater.

Information concerning many types of tubes cannot be deduced as easily as this from the RMA type-numbering system, but in all cases, the first number will at least supply definitely the filament or heater voltage. A study of the type numbers and specifications of some of the tubes listed in the chart in *Section 22*, will aid in understanding this system.

When studying this chart it must be remembered that there are many old type tubes listed—tubes (such as the 00A, 01A, 1, etc.) which were numbered under the old non-RMA numbering system of using merely an arbitrary numeral as explained in *Section 19*. Of course, what has been said here does not apply to *these* tubes.

THE VARIOUS TYPES OF TUBE BASES AND SOCKETS ("STANDARD," "OCTAL," "LOCK-IN," "MINIATURE," ETC.)—AND THE RMA "BASE-PIN" NUMBERING SYSTEMS FOR THEM

MODERN receiving tube development, brought about by the fruits of patient tube research and the requirements of new forms of receivers, has resulted in an increased number of internal element arrangements and new types of base and terminal constructions. The trend is definitely toward greater tube compactness, increased efficiency at the high frequencies, lower filament power requirements, and improved mechanical construction leading toward greater rigidity. The simple Standard 4, 5, 6 and 7-pin receiving tube bases of several years ago have been joined by the newer *octal, lock-in, octalox* and *miniature* bases. Service men have many more tube terminals and tube terminal arrangements to contend with now when analyzing the circuits of the newer receivers for trouble localization, and when testing the individual components. A working familiarity with them is essential for speedy, accurate service work.

For the benefit of those service men who are a bit "confused" about all these types of tube bases, the essential features of their construction and the RMA "base-pin" numbering system which applies to each type now in use is explained here. This RMA system, which has been standardized for all standard tubes, provides a basic systematic method of identifying all the tube terminals.

The Different Kinds of Tube Bases and Terminal Arrangements Now in Use

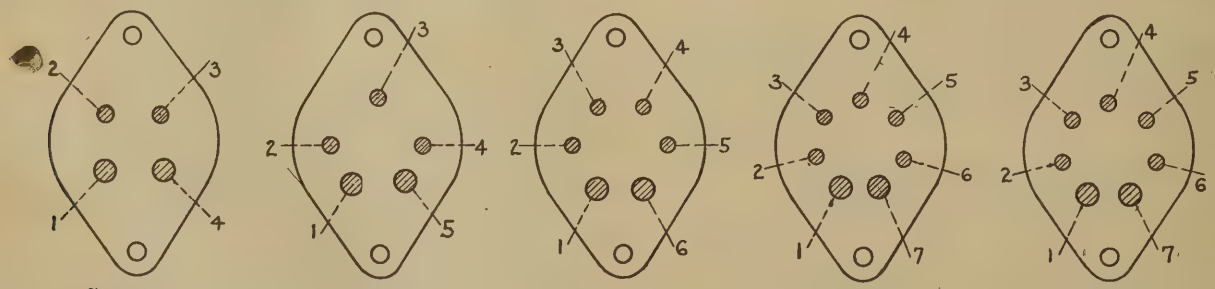
There are, at present, four different kinds of *bases* in use on receiving tubes. These are the *Standard, Octal, Lock-in* and *Miniature.* As some of these employ several different terminal pin arrangements, the complete list of pin arrangements is listed herewith.

(1) the *Standard 4-Pin*
(2) the *Standard 5-Pin*
(3) the *Standard 6-Pin*
(4) the *Small 7-Pin*
(6) the *Octal*
(7) the *Lock-in*
(8) the Miniature *7-Pin* on the "miniature" Type tubes such as the RCA 1R5, 1S4, etc.
(9) the *5-Pin Tube* on "Junior" Bantam type tubes

Each of these requires a different type socket (see Figs. 21-1, 2, 3, 4).

The "Standard" 4 to 7-Pin Tube Bases—and the RMA Base-Pin Numbering System for Them

The Standard 4 to 7-pin tube bases which have been used on the older types of tubes for years are familiar to all service men. In all of these, the two *heater* pins are of larger diameter than the rest, and because of this, may be readily identified.



— *ALL "BOTTOM" VIEWS* —

FIG. 21-1.—"Standard" 4, 5, 6, small-7, and large-7 pin tube sockets (viewed from the *bottom*), showing the tube pin holes and the RMA terminal numbers which apply to them.
Notice that the numbering proceeds in a *clockwise* direction around the socket—starting at the left-hand thick (*heater*) pin No. 1 in each case.

The RMA base-pin numbering system for tubes with this "standard" type of base is as follows:

> *When the tube (or the tube socket) is held "UP-SIDE-down" and with the two "THICK" heater pins toward the observer, the "LEFT" heater pin always is "No. 1," and going around in a "CLOCKWISE" direction, the pin immediately adjacent to it is always the "No. 2" pin, the next*

is "No. 3," etc. This process of numbering continues until the other (RIGHT HAND) heater pin is reached. The right-hand heater pin then bears a number indicative of the total number of pins on the tube base.

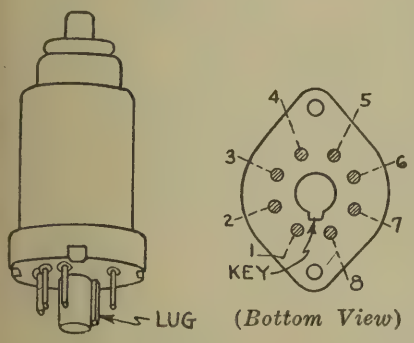
The five illustrations in Fig. 21-1, show the sockets and RMA base-pin numbers for tubes having Standard 4, 5, 6, and small-7, and Standard (large)-7 pin bases (as viewed from the *bottom* of the sockets). These drawings and the pin-numbering shown apply equally well to the corresponding tube bases of course (as viewed from the bottom).

In order to determine which tube element each base pin of a given Standard-based tube connects to, the Tube Socket Connection Diagrams in a Tube Characteristic Chart should be consulted, as will be explained later in this *Section*.

Construction Features of the "Octal"-type Base

The *"octal"* base provided on "metal" tubes (including the single-ended "S"-series), glass "G" tubes, and the larger (GT) Bantam tubes has provision for *eight* similar pins of equal diameter uniformly spaced 45-degrees apart. Where fewer than 8 pins are required, the unnecessary ones are omitted from the tube base *and the spacing of the remaining pins is unchanged.* These tube bases fit into an 8-hole "octal" socket (see Fig. 21-2).

When the terms "large" octal socket and "small" octal socket are employed, they do not mean that there is any difference in the size or spacing of the pin holes—the difference lies merely in the overall outer dimensions of the socket to accommodate octal-based tubes having large-diameter bases (metal tubes) or small-diameter bases (GT Bantam tubes, S-Series Metal tubes) respectively.



— OCTAL —

FIG. 21-2.—An octal-based metal tube (left) showing the "centering" and "locating" lug at the bottom, surrounded by the base pins.

An octal socket (bottom view) is shown at the right. Notice the eight pin holes evenly spaced, and the keyed hole at the center to take the locating lug of the tube.

Notice that the pin numbering proceeds in a *clockwise* direction around the socket — starting at the pin immediately to the left of the lug or key (when viewed from the bottom).

Octal tube bases are provided with a central centering or locating lug placed inside the group of pins. This fits into a corresponding slot or "key" in the tube base as shown in Fig. 21-2.

RMA Pin-Numbering System for "Octal"-type Tube Bases and Sockets

The RMA pin numbering system for octal bases and sockets is shown on the socket in Fig. 21-2. Numbering starts at the *shell* pin which is always the first pin to the *left* of the locating lug when the tube base or socket is viewed from the *bottom*. The numbering sequence progresses *clockwise* (as shown) on the basis of possible pin positions.

In order to determine which tube element each base pin of a given octal-based tube connects to, the Tube Socket Connection Diagrams in a Tube Characteristics Chart should be consulted, as will be explained later in this *Section*.

Construction Features of the "Lock-in" (formerly called "Loktal") Tube Bases and Sockets

The "loktal" or "lock-in" type of tube base construction employed on the "GL" and "ML" series of small glass-envelope tubes is a radical improvement in tube base design. With this type of base, the internal elements of the tube are sealed *directly* into a glass seat or base to which is attached the enclosing glass shell. The stiff terminal lead wires project directly through this glass seat, and at the same time form the actual base pins—thus eliminating the necessity for separate base pins, soldered pin connections, etc. The lower part of the glass envelope fits into a shallow extruded-metal container which forms a metal reinforcing band around the glass envelope and also supplies a central round guide or locating lug (see Fig. 21-3). This lug has a groove around the bottom (very much like an ordinary phone plug), and into this snaps a spring catch or ring in the central metal sleeve of the lock-in type socket. This holds the tube absolutely tight in the socket.

The advantages of the lock-in type base construction are as follows:

(1) "The locking-in feature is of particular importance in aircraft, vehicular and portable radios as the tubes can even be mounted upside down without danger of working out of their sockets. In addition the locking arrangement prevents the tubes from coming out of the sockets during shipment, and it permits the use of small contact pins of extremely uniform diameter. This feature, along with the locking arrangement, makes possible socket construction with good uniform contact and positive seating in the socket."

(2) "The small size and light weight of the lock-in types have obvious advantages in portable sets as well as in other compact chassis constructions."

(3) "The metal base with its integral guide lug makes possible a very well shielded, practical single-ended construc-

tion which became popular after the introduction of the lock-in line. This feature, of course, eliminates loose wires to top caps."

(4) "The appearance of the lock-in type is very attractive and harmonizes with chassis appearance and finish much better than many other types of construction. This feature has appeal to the customer buying a receiver."

(5) "In addition to the above there are other improvements in tube construction in the lock-in line that solve problems that have troubled receiver design engineers. The leads to the elements are extended through a low-loss glass base providing for good performance at high frequencies, thus widening the field of usefulness of the lock-in tubes as higher frequencies are opened to commercial use. This construction of course, eliminates the need for ceramic bases that were necessary with older types when low losses were a requisite. The extension of the leads through the base to become the contact pins eliminates from four to eight soldered connections per tube, thus removing the possibility of trouble sometimes experienced with pin soldering as used in other constructions. The shorter lead length of this construction results in lower lead inductances and reduced inter-element capacitances, while the placing of the "getter" at the top of the mount prevents leakage between leads."

The lock-in base employs *eight* pins (the terminal lead wires really form the pins) uniformly spaced 45-degrees apart, but these pins are of smaller diameter than those used on "octal" bases. They will not fit into an octal socket (or vice versa), but require their own special 8-hole *"lock-in"* socket (see Fig. 21-3) designed with a special central metal sleeve to take the locating and locking-in lug. Although normally all 8 pins are incorporated, if one or more were eliminated the spacing and numbering of the remaining pins would remain unchanged.

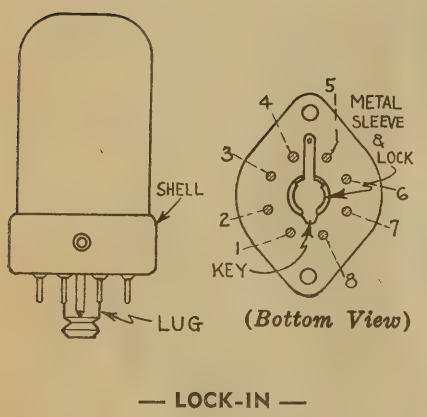


FIG. 21-3.—A lock-in based tube (left) showing the metal retaining shell and the centering lug surrounded by the base pins.

A lock-in socket is shown at the right. Notice the eight pin holes evenly spaced, and the "keyed" metal sleeve and locking ring at the center.

The pin numbering proceeds in a clockwise direction around the socket—starting at the pin immediately to the left of the lug or key (when viewed from the bottom).

Care should be taken in removing lock-in tubes from receivers for, if they are roughly twisted or jerked in removal, they may crack around the base and shatter in the service man's hands, causing painful cuts. When withdrawing a lock-in tube from its socket, a *slight* offside pressure should first be exerted against it to disengage the locating lug from the socket catch. The tube can then be pulled straight out easily.

RMA Pin-Numbering System for "Lock-in"-type Tube Bases and Sockets

The tube-pin numbering system for lock-in tubes is the same as for octal tubes—from No. 1 to 8 in a *clockwise* direction beginning at the locating lug or key, when viewed from the *bottom* of the socket. This is illustrated in Fig. 21-3.

In most cases, the No. 1 and No. 8 pins are used for the heater terminals, the No. 2 pin for the plate, the No. 3 pin for the screen grid, the No. 6 pin for the control grid, and the No. 7 pin for the cathode. A special internal shield is used in certain types and is terminated at the No. 5 pin.

In order to determine which tube element each base pin of a given lock-in-based tube connects to, the Tube Socket Connection Diagrams in a Tube Characteristics Chart should be consulted, as will be explained later in this *Section*.

Lock-in Tubes with "Common" or "Double" Base-Pin Connections

In the construction of the lock-in type tubes everything is done to produce a strong, rugged tube, capable of withstanding severe shocks and vibrations, such as would occur in automobile, aircraft, and portable radio receivers. In order to supply additional support for the electrodes in some tubes which would otherwise have unused base pins, one of these otherwise unused pins is used as an extra support for some electrode that needs it. Since this pin extends through the glass base, as do the other contact pins, the result is that two of the base pins become electrically common to the one electrode. For this reason, it will be found that certain lock-in tube types have two pins which are common to one electrode.

If this possible duplication of base pins is kept in mind it need cause the service man no difficulty in testing tubes, circuits, etc. In receivers which employ these tubes, the *standard* or *usual* pin is normally wired into the receiver circuit and the additional pin is *usually* left unconnected externally—*although this may not necessarily be standard practice in all receivers.*

Following are some lock-in tubes which have two contact pins common to one electrode at the present time. Remembering these tube types should prove helpful:

LOCK-IN TUBE TYPE NO.	"COMMON" ELECTRODE	PINS TO WHICH CONNECTED
7B6	Cathode	4 & 7
7C6	Cathode	4 & 7
7E6	Cathode	4 & 7
14B6	Cathode	4 & 7
14E6	Cathode	4 & 7
1201	Grid	1 & 5

Bases, Sockets and Pin-Numbering Designation for the "Miniature" Series Tubes

The "miniature" series battery tubes (such the 1R5,

1S4, 1S5 and 1T4) use a miniature base and have a maximum overall length of only 2⅛" and a maximum overall diameter of only ¾". This decrease in size was brought about by eliminating the usual base, and by bringing the element connecting wires directly through the seal and a 7-pin glass button base. Thus, as in the case of the lock-in tubes, the wires themselves serve as tube pins. The socket used for these tubes is of a special small size with 7 holes arranged to take the

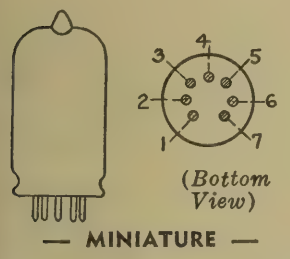


FIG. 21-4. — A "miniature" type tube, and a 7-pin miniature socket (viewed from the bottom) for it. Notice the pin-numbering sequence marked on the socket.

pins. The numbering of the pins proceeds from 1 to 7 in a *clockwise* direction around the pins or socket as illustrated in Fig. 21-4.

As these tubes are considerably smaller than conventional tube types, they allow even more compact receiver construction. Another equally important feature is that they operate efficiently on 45 volts instead of the usually required 90-volt B supply. This effects a saving of one half the previously required "B" battery space and weight.

Bases and Sockets for the "Junior" Bantam Type Tubes

A special series of miniature "Junior Bantam" type tubes (not to be confused with the larger GT "Bantam" types employing an *octal* base) are made for extremely compact equipment—such as hearing aids, etc. The Hytron HY113, HY115 and HY125 tubes are examples of these. The filaments of these compact tubes (only 2.19 inches high) operate on 1.25 volts (a single dry cell). A special small 5-pin socket (usually containing a snap-on mounting ring) is employed for them. The numbering of the pins is *clockwise* (from No. 1 to No. 5) when the tube or socket is viewed from the bottom.

How to Determine Which Tube Element Each Base-Pin of any Tube Connects to

It should be understood and remembered that the RMA system of tube base-pin numbering of itself pertains only to the numbering and identification of the *tube pins* (and socket terminals), and not to the internal structure or elements of the tube directly. For example, as will be evident from an examination of the Tube Base Pin (or Tube Socket) Connection Diagrams at the rear of the chart in *Section 22* of this Handbook, the No. 2 pin on one tube may connect to the *plate*, whereas the No. 2 pin on some other tube (say the tube represented in diagram 5J) may connect to a *grid*, etc. However, if the information shown by such Tube Base Connection Diagrams (which form part of every tube manufacturer's Tube Characteristics Chart) is combined with a knowledge of the RMA base pin numbering system just explained, the exact base pin to which each different tube electrode is connected (and vice versa) may be quickly determined for any tube type. The following example will serve to illustrate this:

Suppose it is desired to determine which tube electrode is connected to each of the six base pins of a type 79 twin amplifier tube. Referring to the left-hand column in the Tube characteristics Chart in *Section 22* we find the type 79 listed. Now going over to the fourth column from the left we find that the 79 tube has a Base Connection Diagram whose "key" number is 6H. Locating base diagram 6H among the base diagrams further back in the chart, and referring to it, we see that in this tube the No. 1 pin connects to one side of the heater, the No. 2 pin connects to the plate of one triode section, the No. 3 pin connects to its control grid, the No. 4 pin connects to the common cathode, the top cap connects to the control grid of the other triode section, the No. 5 pin connects to its plate, and the No. 6 pin connects to the other end of the heater. With this information, and a knowledge of the RMA base-pin designation system explained here, the service man can immediately identify each base pin of the tube (or each terminal of its socket) for making any desired circuit tests.

The "key" numbers for these various tube base connection diagrams have been standardized by the RMA, so any given "key" number always stands for the same base diagram regardless of the source of information.

RECEIVING TUBE OPERATING CHARACTERISTICS AND BASE-PIN & SOCKET CONNECTION DIAGRAMS

THE *Receiving Tube Characteristics and Basing Charts* on the following 17 pages have been revised and brought up to date. They now present data on a total of 1,042 commercial receiving tube types—the most complete tube listing ever made available to the radio service man. The data is listed in two charts which follow each other. The first presents data on 742 commercial tube types. The second chart (the Supplementary Chart on pages 606-608) lists the data for approximately 300 additional commercial tube types not normally listed by American tube manufacturers but for which data is often needed by service men in the U. S. A. and Foreign Countries when servicing old-model receivers. It includes many Canadian tube types. The tubes are listed in the numerical and alphabetical order of their type numbers, without regard to their class of application. This is the best arrangement as it makes possible rapid reference.

Base-Pin and Socket Connection Diagrams

The *Base-Pin and Socket-Connection Diagrams* which follow (pages 609-611) these *Characteristics Charts*, show the base terminal connections as they appear when looking up at the bottom of the sockets. The reference "key" number below each socket connection diagram refers to the "code" or "key" number which will be found in the *Base Connection* column (the *fourth* column from the left in the *main* tube chart; the second column from the left in the *supplementary* tube chart) for each tube listed. These Base Connection Diagrams are key-numbered according to an RMA standard numbering system, *with the exception* of *Base Connection code* numbers starting with the letter "X." Thus, Base Connection codes *X1, X2, X3,* etc. are not standard RMA designations. The Base Connection Diagrams for these are given in a separate chart on page 611.

How To Use The Charts

This Master Tube Chart can be used to find all tube information of practical use to radio service men.

For example, if a service man needs information regarding a type *KR1* tube, he should look up *KR1* in the left-hand column of the main tube chart and he will find that this is a half-wave rectifier tube which may now be replaced with a type *1V*. If the tube looked up is not listed on the first (main tube chart, look for it on the "supplementary" chart. An example of this would be the type *16* tube (which is now replaceable by the type *81*).

The type numbers of many replacement tubes among glass, metal, and metal-glass octal tube types are also given in the column at the extreme right. In almost all cases the metal, G, MG, GT, etc. variations of any one tube type are interchangeable. However, if the tubes are located in the i-f stages, this may require realignment of the i-f amplifier for best operating results.

Because the service man now encounters so many tube types and tube base terminal arrangements, it is not possible for him to remember the arrangement used in every tube type. But he can obtain all needed information from this chart. Thus, if the base connections on a *1A7GT* are desired, the listing for the *1A7GT* tube should be located on the main *Tube Characteristics Chart*. The fourth column from the left tells us that the base-pin connections for this tube are arranged in accordance with base pin diagram *7Z*. This diagram may then be located and referred to in the *Base-Pin and Socket-Connection Diagram Chart* which follows here.

Similarly, such information as filament voltage, average operating voltages, average operating currents, mutual conductance, etc. is available.

Tube Types for Direct Substitution

It is important to remember that the *"similar"* tube types listed in the second column from the left are tubes which have electrical characteristics and circuit applications *similar* to the listed types. It does not necessarily follow that they may be used for direct substitution of the listed types without requiring changes in the circuit constants or wiring, unless they also appear in the *"Replace with"* column at the extreme right. For a complete chart giving correlation of tube types for substitution, see *Sect. 23.*

The author wishes to express his sincere appreciation to the National Union Radio Corporation for permission to reproduce the "main" *Tube Characteristics* and *Base-Pin Diagram Charts*, and to Mr. Samuel C. Milbourne for his able and valuable assistance in compiling the data for the "supplementary" *Tube Characteristics Chart* and *Special Tube Base Chart.*

(See next page)

RECEIVING TUBE OPERATING CHARACTERISTICS AND BASING CHART*

Type Number	Similar To	Description	Base Connection	Filament Volts	Filament Amps.	Filament Type	Plate Volts	Screen Volts	Control Grid Volts	Plate Current (MA)	Screen Current (MA)	Amplification Factor	Mutual Conductance in Micromhos	Power Output in Milliwatts	Load Resistance in Ohms	
0A4G		Cold Cathode Rectifier	4V Anode	Volts	RMS 105-130		Maximum Cathode Current		Peak D.C.	100 M.A. 25 M.A.		A.C. & R.F.	Starter Anode Volts 110 Min.			NU
0Z3	—	Full Wave Gaseous Rectifier	5N	—	—	Cold	350	—	—	75	—	—	—	—	—	
0Z4	0Z3	Full Wave Gaseous Rectifier •	4R	—	—	Cold	350	—	—	75	—	—	—	—	—	NU
0Z4G		Full Wave Gaseous Rectifier	4R	—	—	Cold	350	—	—	75	—	—	—	—	—	NU
00	01A	Triode Detector-Gas	4D	5.0	0.250	F(T)	45 max.	—	0	—	—	—	—	—	—	Replace with NU01A
00A	40	Triode Detector-Gas	4D	5.0	0.250	F(T)	45 max.	—	0	1.5	—	20	666	—	—	Replace with NU01A
01	01A	Triode Detector-Amplifier	4D	5.0	0.250	F(T)	90	—	— 4.5	2.5	—	8	—	—	—	Replace with NU01A
01A	—	Triode Detector-Amplifier	4D	5.0	0.250	F(T)	90 135	— —	— 4.5 — 9.0	2.5 3.0	— —	8 8	725 800	— —	— —	NU
01AA	01A	Triode Detector-Amplifier	4D	5.0	0.250	F(O)	90	—	— 4.5	3.2	—	8	850	—	—	NU
01B	01A	Triode Detector-Amplifier	4D	5.0	0.1250	F(T)	90	—	— 4.5	2.5	—	8	725	—	—	Replace with NU01A
1	8Z3-IV	Half Wave Rectifier	4G	6.3	0.300	C	350 max.	—	—	50	—	—	—	—	—	Replace with NU1V
KR1	8Z3-IV	Half Wave Rectifier	4G	6.3	0.300	C	350 max.	—	—	50	—	—	—	—	—	Replace with NU1V
RA1	—	Amplifier	4Q	15.0	0.350	C	90	—	— 4.5	4.5	—	11	1185	—	—	Obsolete
RE1	80	Full Wave Rectifier	4C	5.0	2.000	F(O)	350 max.	—	—	125	—	—	—	—	—	Replace with NU80
RE2	81	Half Wave Rectifier	4B	7.5	1.250	F(O)	700 max.	—	—	85	—	—	—	—	—	Replace with NU81
S01	—	Amplifier	4Q	15.0	0.400	C	180	—	—40.5	21	—	3	1500	—	—	Obsolete
S02	50	Amplifier	4D	7.5	1.250	F(O)	450	—	—34	5*	—	3.8	2100	4600	4350	Replace with NU50
1A1	—	Current Regulator	4A	0.7	0.500	F	—	—	—	—	—	—	—	—	—	
1A4	34-1D5G	Super Control R.F. Amplifier	4K	2.0	0.060	F(O)	180	67.5	— 3.0	2.3	0.70	720	750	—	—	NU
1A4P	—	Super Control R.F. Pentode	4M	2.0	0.060	F(O)	180	67.5	— 3.0	2.3	0.8	750	750	—	—	Replace with NU1A4
1A4T	1A4	Super Control R.F. Tetrode†	4K	2.0	0.060	F(O)	180	67.5	— 3.0	2.3	0.7	720	750	—	—	Replace with NU1A4
1A5G		Power Output Pentode	6X	1.40	.050	F(O)	85	85	— 4.5	3.5	.70	—	800	100	25,000	Replace with NU 1A5GT/G
1A5GT	1A5G	Power Output Pentode	6X	1.4	0.050	F(O)	85	85	— 4.5	3.5	0.7	—	800	100	25000	Replace with NU 1A5GT/G
1A5GT/G	1A5G	Power Output Pentode	6X	1.4	0.050	F(O)	85	85	— 4.5	3.5	0.70	—	800	100	25000	NU
1A6	1C6-1D7G	Pentagrid Converter	6L	2.0	0.060	F(O)	135 180	67.5 67.5	— 3.0 — 3.0	1.2 1.3	2.5 2.4	— —	275 300	— —	— —	NU
1A7G		Pentagrid Converter	7Z	1.40	.050	F(O)	90	90	0	.60	.65	—	125	—	—	NU
1A7GT	1A7G	Pentagrid Converter	7Z	1.4	0.050	F(O)	90	45	0	0.55	0.60	—	250	—	—	NU
1B1	—	Current Regulator	4A	0.7	0.360	F	—	—	—	—	—	—	—	—	—	
1B4	32-1E5G	Screen Grid R. F. Amplifier	4K	2.0	0.060	F(O)	180	67.5	— 3.0	1.7	0.4	780	650	—	—	NU
1B4P	—	Screen Grid R.F. Pentode	4M	2.0	0.060	F(O)	180	67.5	— 3.0	1.7	0.6	1000	650	—	—	Replace with NU1B4
1B4T	1B4	Screen Grid R.F. Tetrode†	4K	2.0	0.060	F(O)	180	67.5	— 3.0	1.7	0.4	780	650	—	—	Replace with NU1B4
1B5-25S	1H6G	Duplex Diode Triode	6M	2.0	0.060	F(O)	135	—	— 3.0	0.8	—	20	575	—	—	NU
1B7G	1A7G	Pentagrid Converter	7Z	1.4	0.100	F(O)	90	45	0	1.5	1.3	—	350	—	—	NU
1B7GT	1B7G	Pentagrid Converter	7Z	1.4	0.100	F(O)	90	45	0	1.5	1.3	—	350	—	—	Replace with NU1B7G
1B83T		Diode-Triode-Beam Power Amplifier	8AW	1.4	0.100	F(O)	T90 P90	— 90	0 — 8.0	0.15 6.3	— 1.4	— —	275 1150	— 210	— 14000	
1C1	—	Current Regulator	4A	0.7	0.740	F	—	—	—	—	—	—	—	—	—	
1C5G		Power Output Pentode	6X	1.40	.100	F(O)	90	90	— 9.0	6.0	1.4	180	1550	240	8000	Replace with NU 1C5GT/G
1C5GT	1C5G	Power Output Pentode	6X	1.4	0.100	F(O)	90	90	— 9.0	6.0	1.4	180	1550	240	8000	Replace with NU 1C5GT/G
1C5GT/G	1C5G	Power Output Pentode	6X	1.4	0.100	F(O)	90	90	— 9.0	6.0	1.4	180	1550	240	8000	NU
1C6	1A6-1C7G	Pentagrid Converter	6L	2.0	0.120	F(O)	135 180	67.5 67.5	— 3.0 — 3.0	1.3 1.5	2.0 2.0	— —	300 325	— —	— —	NU
1C7G	1C6	Pentagrid Converter•	7Z	2.0	0.120	F(O)	135 180	67.5 67.5	— 3.0 — 3.0	1.3 1.5	2.0 2.0	— —	300 325	— —	— —	NU
1D2	—	Current Regulator	4U	0.7	0.420	F	—	—	—	—	—	—	—	—	—	
1D5G	1A4	Super Control R.F. Amplifier•	5R	2.0	0.060	F(O)	180	67.5	— 3.0	2.3	0.7	720	750	—	—	Replace with NU1D5GT
1D5GP	—	Super Control R.F. Pentode•	5Y	2.0	0.060	F(O)	180	67.5	— 3.0	2.3	0.8	750	750	—	—	NU
1D5GT	1A4	Super Control R.F. Tetrode•	5R	2.0	0.060	F(O)	180	67.5	— 3.0	2.3	0.7	720	750	—	—	NU
1D7G	1A6	Pentagrid Converter•	7Z	2.0	0.060	F(O)	135 180	67.5 67.5	— 3.0 — 3.0	1.2 1.3	2.5 2.4	— —	275 300	— —	— —	NU
1D8GT		Diode Triode Power Amplifier Pentode	8AJ	1.4	0.100	F(O)	90 90	90 (Triode)	— 9.0 0	5.0 1.1	1.0 —	— 25	925 575	200 —	12000 —	NU
1E1	—	Current Regulator	4A	0.7	0.480	F	—	—	—	—	—	—	—	—	—	
1E2	—	Current Regulator	4U	0.9	0.660	F	—	—	—	—	—	—	—	—	—	
1E4G	—	Triode Voltage Amplifier	5S	1.4	0.050	F(O)	90	—	— 3.0	1.5	—	14	825	—	—	NU
1E5G	1B4	Screen Grid R.F. Amplifier•	5R	2.0	0.060	F(O)	180	67.5	— 3.0	1.7	0.4	780	650	—	—	NU
1E5GP	—	Screen Grid R.F.Pentode•	5Y	2.0	0.060	F(O)	180	67.5	— 3.0	1.7	0.6	1000	650	—	—	Replace with NU1E5G
1E5GT	1B4	Screen Grid R.F. Tetrode†•	5R	2.0	0.060	F(O)	180	67.5	— 3.0	1.7	0.4	780	650	—	—	Replace with NU1E5G
1E7G	2-1F4	Double Pentode Power Amplifier •	8C	2.0	0.240	F(O)	135	135	— 4.5	7.5	2.1	350	1600	—	—	NU
1F1	—	Current Regulator	4A	0.7	0.720	F	—	—	—	—	—	—	—	—	—	
1F4	950-1F5G	Output Pentode	5K	2.0	0.120	F(O)	135	135	— 4.5	8.0	2.6	360	1700	340	16000	NU
1F5G	950-1F4	Output Pentode •	6X	2.0	0.120	F(O)	135	135	— 4.5	8.0	2.6	360	1700	340	16000	NU
1F6	—	Duplex Diode Pentode	6W	2.0	0.060	F(O)	180	67.5	— 1.5	2.0	0.6	650	650	—	—	NU
1F7G	1F6	Duplex Diode Pentode •	7AD	2.0	0.060	F(O)	180	67.5	— 1.5	2.0	0.6	650	650	—	—	Replace with NU1F7GV
1F7GH	1F6	Duplex Diode Pentode	7AD	2.0	0.060	F(O)	180	67.5	— 1.5	2.0	0.6	650	650	—	—	NU
1F7GV	1F6	Duplex Diode Pentode	7AF	2.0	0.060	F(O)	180	67.5	— 1.5	2.0	0.6	650	650	—	—	NU
1G1	—	Current Regulator	4A	0.7	0.420	F	—	—	—	—	—	—	—	—	—	
1G4G	—	Triode Voltage Amplifier	5S	1.4	0.050	F(O)	90	—	— 6.0	2.3	—	8.8	825	—	—	Replace with NU 1G4GT/G
1G4GT	1G4G	Triode Voltage Amplifier	5S	1.4	0.050	F(O)	90	—	— 6.0	2.3	—	8.8	825	—	—	Replace with NU 1G4GT/G
1G4GT/G	1G4G	Triode Voltage Amplifier	5S	1.4	0.050	F(O)	90	—	— 6.0	2.3	—	8.8	825	—	—	NU

Reprinted by courtesy the Engineering Dept. National Union Radio Corp.

(Cont'd over)

Note: *(If a tube whose data is desired is not listed in this tube chart, see "Supplementary Tube Chart" on Pages 606 to 608.)*

(Cont'd)

Type Number	Similar To	Description	Base Connection	Filament Volts	Filament Amps.	Filament Type	Plate Volts	Screen Volts	Control Grid Volts	Plate Current (MA)	Screen Current (MA)	Amplification Factor	Mutual Conductance in Micromhos	Power Output in Milliwatts	Lead Resistance in Ohms	
1G5G	1F4	Output Pentode°	6X	2.0	0.120	F(O)	90	90	— 6.0	8.5	2.7	200	1500	300	8500	NU
1G6G	—	Class B Twin Triode	7AB	1.4	0.100	F(O)	90	—	0	14.0	—	—	—	—	—	Replace with NU 1G6GT/G
1G6GT	1G6G	Class B Twin Amplifier	7AB	1.4	0.100	F(O)	90	—	0	14.0	—	—	—	675(2)	12000(2)	Replace with NU 1G6GT/G
1G6GT/G	1G6G	Class B Twin Amplifier	7AB	1.4	0.100	F(O)	90	—	0	14.0	—	—	—	675(2)	12000(2)	NU
1H4G	30	Triode Detector-Amplifier	5S	2.0	0.060	F(O)	180	—	—13.5	3.1	—	9.3	900	—	—	NU
1H5G		Diode-Triode	5Z	1.40	.050	F(O)	90	—	0	.15	—	65	275	—	—	NU
1H5GT	1H5G	Diode Triode	5Z	1.4	0.050	F(O)	90	—	0	0.15	—	65	275	—	—	NU
1H6G	1B5	Duplex Diode Triode °	7AA	2.0	0.060	F(O)	135	—	— 3.0	0.8	—	20	575	—	—	NU
1J1	—	Current Regulator	4A	0.7	0.620	—	—	—	—	—	—	—	—	—	—	
1J5G	950	Power Amplifier Pentode	6X	2.0	0.120	F(O)	135	135	—16.5	7.0	2	100	950	—	—	NU
1J6G	19	Class B Twin Amplifier	7AB	2.0	0.240	F(O)	135	—	0	10.0	—	—	—	2100(2)	10000(2)	NU
1K1	—	Current Regulator	4A	0.7	0.550	F	—	—	—	—	—	—	—	—	—	
1L1	1B1	Current Regulator °	4T	0.7	0.380	—	—	—	—	—	—	—	—	—	—	
1LA4		Power Output Pentode	5AD	1.4	0.050	F(O)	90	90	— 4.5	4.0	0.8	—	850	115	25000	NU
1LA6		Frequency Converter	7AK	1.4	0.050	F(O)	90	45	0	0.55	0.60	—	250	—	—	NU
1LB4	—	Power Output Pentode	5AD	1.4	0.050	F(O)	90	90	— 9.0	5.0	1.0	—	925	200	12000	NU
1LB6	—	Pentagrid Mixer	8AX	1.4	0.050	F(O)	90	67.5	0	0.4	2.2	—	100	—	—	
1LC5	—	R. F. Pentode	7AO	1.4	0.050	F(O)	90	45	0	1.15	0.20	—	775	—	—	NU
1LC6	—	Pentagrid Converter	7AK	1.4	0.050	F(O)	90	35	0	0.75	0.70	—	275	—	—	NU
1LD5	—	Diode-Audio Pentode	6AX	1.4	0.050	F(O)	90	45	0	0.60	0.10	—	575	—	—	NU
1LE3	—	General Purpose Triode	4AA	1.4	0.050	F(O)	90	—	— 3.0	1.40	—	14.5	760	—	—	NU
1LH4		Diode Triode	5AG	1.4	0.050	F(O)	90	—	0	0.15	—	65	275	—	—	NU
1LN5		Pentode Voltage Amplifier	7AO	1.4	0.050	F(O)	90	90	0	1.6	0.35	880	800	—	—	NU
1N1	1E1	Current Regulator °	4T	0.7	0.480	—	—	—	—	—	—	—	—	—	—	
1N5G		Radio Frequency Pentode	5Y	1.40	0.050	F(O)	90	90	0	1.2	.3	1125	750	—	—	NU
1N5GT	1N5G	R.F. Pentode Amplifier	5Y	1.4	0.050	F(O)	90	90	0	1.2	0.3	—	750	—	—	NU
1N6G	—	Diode-Power Output Pentode	7AM	1.4	0.050	F(O)	90	90	— 4.5	3.1	0.6	—	800	100	25000	NU
1N6GT	1N6G	Diode Power Output Pentode	7AM	1.4	0.050	F(O)	90	90	— 4.5	3.1	0.6	—	800	100	25000	Replace with NU 1N6G
1P1	1G1	Current Regulator °	4T	0.7	0.420	—	—	—	—	—	—	—	—	—	—	
1P5G	1D5GP	R.F. Pentode Amplifier	5Y	1.4	0.050	F(O)	90	90	0	2.3	0.7	640	800	—	—	Replace with NU 1P5GT
1P5GT	1P5G	R.F. Pentode Amplifier	5Y	1.4	0.050	F(O)	90	90	0	2.3	0.7	640	800	—	—	NU
1Q1	1F1	Current Regulator °	4T	0.7	0.720	—	—	—	—	—	—	—	—	—	—	
1Q5G	—	Beam Power Output Amplifier	6AF	1.4	0.100	F(O)	90	90	— 4.5	9.5	1.6	—	2100	270	8000	Replace with NU 1Q5GT/G
1Q5GT	1Q5G	Beam Power Output Amplifier	6AF	1.4	0.100	F(O)	90	90	— 4.5	9.5	1.6	—	2100	270	8000	Replace with NU 1Q5GT/G
1Q5GT/G	1Q5G	Beam Power Output Amplifier	6AF	1.4	0.100	F(O)	90	90	— 4.5	9.5	1.6	—	2100	270	8000	NU
1R1G	—	Current Regulator °	4T	0.7	0.540	F	—	—	—	—	—	—	—	—	—	
1R5	—	Pentagrid Converter	7AT	1.4	0.050	F(O)	90	45	0	0.8	1.8	—	250	—	—	NU
1S1G	—	Current Regulator °	4T	0.7	0.660	F	—	—	—	—	—	—	—	—	—	
1S4	—	Power Amplifier Pentode	7AV	1.4	0.100	F(O)	45	45	— 4.5	3.8	0.8	—	1250	65	8000	NU
1S5	—	Diode-Pentode	6AU	1.4	0.050	F(O)	45	45	0	1.2	0.3	—	525	—	—	NU
1SA6GT	—	R. F. Pentode	6BD	1.4	0.050	F(O)	90	67.5	0	2.45	0.68	—	970	—	—	NU
1SB6GT	—	Diode-Pentode	6BE	1.4	0.050	F(O)	90	67.5	0	1.45	0.38	—	665	—	—	NU
1T1G	—	Current Regulator °	4T	0.7	0.560	F	—	—	—	—	—	—	—	—	—	
1T4	—	Super Control R.F. Amplifier	6AR	1.4	0.050	F(O)	90	45	0	2.0	0.65	—	750	—	—	NU
1T5GT		Beam Power Output Amplifier	6X	1.4	0.060	F(O)	90	90	— 6.0	6.5	1.4	—	1150	170	14000	NU
1U1	—	Current Regulator °	4T	0.7	0.740	F	—	—	—	—	—	—	—	—	—	
1V	6Z3	Half Wave Rectifier	4G	6.3	0.300	C	350	—	—	50	—	—	—	—	—	NU
1V1	—	Current Regulator	4A	0.7	0.560	F	—	—	—	—	—	—	—	—	—	
1W1		Current Regulator	—	1.0	0.600	—	—	—	—	—	—	—	—	—	—	
1Y1	—	Current Regulator	4A	0.7	0.540	F	—	—	—	—	—	—	—	—	—	
1Z1	—	Current Regulator	4A	0.7	0.900	F	—	—	—	—	—	—	—	—	—	
2	—	Ballast Tube	4A	9.0	0.300	F	—	—	—	—	—	—	—	—	—	
2A3	—	Power Amplifier Triode	4D	2.5	2.500	F(O)	250 300	 Push-Pull	—45 —62	60 40	—	4.2	5250	3500 15000	2500 3000	NU
2A3H	2A3	Power Amplifier Triode	4Q	2.5	2.500	C	250 300	 Push-Pull	—45 —62	60 40	—	4.2	5250	3500 15000	2500 3000	Replace with NU2A3
2A4G		Thyratron Tube	5S	2.50	2.500	F(O)	200	—	—	100	—	—	—	—	—	NU
2A5	—	Power Amplifier Pentode	6B	2.5	1.750	C	250	250	—16.5	34	6.5	220	2200	3000	7000	NU
2A6	—	Duplex Diode Triode	6G	2.5	0.800	C	250	—	— 2.0	0.8	—	100	1100	—	100,000	NU
2A7	—	Pentagrid Converter	7C	2.5	0.800	C	250 100	100 50	— 3.0 — 1.5	3.5 1.3	2.2 2.5	—	520 350	—	—	NU
2A7S	2A7	Pentagrid Converter with Shield	7C	2.5	0.800	C	250 100	100 50	— 3.0 — 1.5	3.5 1.3	2.5 2.5	—	520 350	—	—	NU
2B6	—	Power Amplifier Direct Coupled	7J	2.5	2.250	C	250 250	Input Output	—24.0 + 2.5	4 40	— —	7.2 18	600 3500	— 4000	8000 5000	
2B7	—	Duplex Diode Pentode	7D	2.5	0.800	C	250 100	152 100	— 8.0 — 3.0	9.0 5.8	2.3 1.7	730 285	1125 950	— —	— —	NU
2B7S	2B7	Duplex Diode Pentode with Shield	7D	2.5	0.800	C	250 100	125 100	— 3.0 — 3.0	9.0 5.8	2.3 1.7	730 285	1125 950	— —	— —	
2E5	—	Electron Ray Tuning Indicator	6R	2.5	0.800	C	250	—	0 to - 8	—	—	—	—	—	—	NU
2G5	—	Electron Ray Tuning Indicator	6R	2.5	0.800	C	250	—	0 to -22	—	—	—	—	—	—	
62-82S	56-27	Duplex Diode	5D	2.5	1.750	C	—	—	—	—	—	—	—	—	—	
2V3G	—	Half Wave Rectifier	4Y	2.5	5.000	F(T)	16500	Inverse	—	2.0	—	—	—	—	—	NU
2W3		Half Wave Rectifier	4X	2.5	1.500	F(O)	350	—	—	55	—	—	—	—	—	NU
2W3GT	2W3	Half Wave Rectifier	4X	2.5	1.500	F(O)	350	—	—	55	—	—	—	—	—	Replace with NU 2W3
2X2/879		High Voltage Half Wave Rectifier	4AB	2.5	1.750	C	4500	—	—	7.5	—	—	—	—	—	NU

Note: *(If a tube whose data is desired is not listed in this tube chart, see "Supplementary Tube Chart" on Pages 606 to 608.)*

(Cont'd)

Receiving Tube Operating Characteristics and Basing Diagram Charts

(Cont'd)

Type Number	Similar To	Description	Base Connection	Filament Volts	Filament Amps.	Filament Type	Plate Volts	Screen Volts	Control Grid Volts	Plate Current (MA)	Screen Current (MA)	Amplification Factor	Mutual Conductance in Micromhos	Power Output in Milliwatts	Load Resistance in Ohms	
2Y2	—	Half Wave Rectifier	4AB	2.5	1.750	C	4400	—	—	5.0	—	—	—	—	—	Replace with NU 2X2/879
2Z2-G84	—	Half Wave Rectifier	4B	2.5	1.500	F	350	—	—	50	—	—	—	—	—	
8	—	Ballast Tube	4A	128.0	0.300	F	—	—	—	—	—	—	—	—	—	
3A8GT	—	Diode-Triode-Pentode	8AS	2.8 1.4	0.050 0.100	F(O)	T90 P90	— 90	0 0	8.15 1.2	— 0.5	65 —	275 750	— —	— —	NU
3B5GT	—	Beam Power Output Amplifier	7AP	2.8	0.050	F(O)	67.5	67.5	— 7.0	6.7	0.5	—	1500	180	5000	NU
3C5GT	1C5G	Power Output Pentode	7AQ	1.4 2.8	0.100 0.050	F(O) F(O)	90 90	90 90	— 9.0 — 9.0	6.0 6.0	1.4 1.4	— —	1550 1450	240 260	8000 10000	
3LE4	1E4G	Power Amplifier Pentode	6BA	2.8 1.4	0.050 0.100	F(O)	90	90	— 9.0	10.9	2.0	—	1750	325	6000	
3LF4	—	Beam Power Amplifier	6BB	2.8 1.4	.05 .10	F F	90 90	90 90	— 4.5 — 4.5	8.0 9.5	1.0 1.3	— —	2000 2200	0.230 0.270	8000 8000	
3Q4	—	Power Amplifier Pentode	7BA	2.8	0.050	F(O)	90	90	— 4.5	7.7	1.7	—	2000	240	10000	
3Q5G	1Q5G	Beam Power Output Amplifier	7AP	2.8 1.4	0.050 0.100	F(O)	90 90	90 90	— 4.5 — 4.5	7.5 9.5	1.0 1.6	— —	1800 2100	250 270	8000 8000	Replace with NU 3Q5GT/G
3Q5GT	1Q5G	Beam Power Output Amplifier	7AP	1.4 2.8	0.100 0.050	F(O)	90 90	90 90	— 4.5 — 4.5	9.5 7.5	1.6 1.0	— —	2100 1800	270 250	8000 8000	Replace with NU 3Q5GT/G
3Q5GT/G	1Q5G	Beam Power Output Amplifier	7AP	1.4 2.8	0.100 0.050	F(O)	90 90	90 90	— 4.5 — 4.5	9.5 7.5	1.6 1.0	— —	2100 1800	270 250	8000 8000	NU
3S4	—	Power Amplifier Pentode		2.8 1.4	0.050 0.100	F(O)	67.5 67.5	67.5 67.5	— 7.0 — 7.0	6.0 7.2	1.2 1.5	— —	1400 1550	160 180	5000 5000	NU
4A6G		Class B Twin Amplifier	8L	4.0 2.0	.060 .120	F(O)	90	—	— 2.0	21				1000	8000(P-P)	NU
4	—	Ballast Tube	4A	115.0	0.300	F	—	—	—	—	—	—	—	—	—	
84-G4S	56-27	Duplex Diode	5D	2.5	1.000	C	—	—	—	—	—	—	—	—	—	
5	—	Ballast Tube	4A	115.0	0.460	F	—	—	—	—	—	—	—	—	—	
KR5	6A4	Power Amplifier Pentode	5B	6.3	0.300	F	135	135	— 9.0	14	2.5	100	1900	700	9500	Replace with NU6A4
‡5T4	5Z3	Full Wave Rectifier°	5T	5.0	2.000	F(O)	450	—	—	250	—	—	—	—	—	NU
5U4G	5Z3	Full Wave Rectifier°	5T	5.0	2.000	F(O)	500	—	—	250	—	—	—	—	—	NU
5V4G	83V	Full Wave Rectifier °	5L	5.0	2.000	C	400	—	—	200	—	—	—	—	—	NU
‡5W4	80	Full Wave Rectifier °	5T	5.0	1.500	F(O)	350	—	—	110	—	—	—	—	—	Replace with NU 5W4GT/G
5W4G	80	Full Wave Rectifier	5T	5.0	1.500	F(O)	350	—	—	110	—	—	—	—	—	Replace with NU 5W4GT/G
5W4GT	80	Full Wave Rectifier	5T	5.0	1.5	F(O)	400	—	—	90	—	—	—	—	—	Replace with NU 5W4GT/G
5W4GT/G	80	Full Wave Rectifier°	5T	5.0	1.500	F(O)	400	—	—	90	—	—	—	—	—	NU
5X3	—	Full Wave Rectifier	4C	5.0	2.0	F(O)	1275	—	—	30	—	—	—	—	—	
5X4G	5Z3	Full Wave Rectifier °	5Q	5.0	3.000	F(O)	500	—	—	250	—	—	—	—	—	NU
5Y3G	80	Full Wave Rectifier °	5T	5.0	2.000	F(O)	400	—	—	110	—	—	—	—	—	NU
5Y3GT/G	80	Full Wave Rectifier°	5T	5.0	2.000	F(O)	350	—	—	125	—	—	—	—	—	
5Y4G	80	Full Wave Rectifier °	5Q	5.0	2.000	F(O)	400	—	—	110	—	—	—	—	—	NU
5Z3	—	Full Wave Rectifier	4C	5.0	3.000	F(O)	500	—	—	250	—	—	—	—	—	NU
‡5Z4	—	Full Wave Rectifier °	5L	5.0	2.000	C	400	—	—	125	—	—	—	—	—	Replace with NU5Z4GT/G
5Z4G	5Z4	Full Wave Rectifier °	5L	5.0	2.000	C	400	—	—	125	—	—	—	—	—	Replace with NU5Z4GT/G
5Z4GT/G	5Z4	Full Wave Rectifier°	5L	5.0	2.000	C	350	—	—	125	—	—	—	—	—	NU
5Z4MG	5Z4	Full Wave Rectifier °	5L	5.0	2.000	C	400	—	—	125	—	—	—	—	—	Replace with NU5Z4GT/G
6	—	Ballast Tube	4A	1.0	0.695	F	—	—	—	—	—	—	—	—	—	
6A3	—	Power Amplifier Triode	4D	6.3	1.000	F(O)	250 300	Push-Pull	—45 —62	60 40	— —	4.2 —	5250 —	3500 15000	2500 3000	NU
6A4	—	Power Amplifier Pentode	5B	6.3	0.300	F(O)	180 100	180 100	—12.0 — 6.5	22 9	3.9 1.6	100 100	2200 1200	1400 310	8000 11000	NU
6A5G	6A3	Power Amplifier Triode°	6T	6.3	1.000	C	250	—	—45	60	—	4.2	5250	3750	2500	NU
6A6	—	Class B Twin Amplifier	7B	6.3	0.800	C	294 360	Class A Class B	— 0.0 8	7 17.5	— —	35 —	3200 —	— 10000	— 10000(2)	NU
6A7	—	Pentagrid Converter	7C	6.3	0.300	C	250 100	100 50	— 3.0 — 1.5	3.6 1.3	2.2 2.5	— —	620 350	— —	— —	NU
6A7S	6A7	Pentagrid Converter	7C	6.3	0.300	C	250 100	100 50	— 3.0 — 1.5	3.5 1.3	2.2 2.5	— —	620 350	— —	— —	NU
‡6A8	6A7	Pentagrid Converter °	8A	6.3	0.300	C	250 100	100 50	— 3.0 — 1.5	3.3 1.2	3.2 1.5	— —	500 350	— —	— —	Replace with NU 6A8GT
6A8G	6A7	Pentagrid Converter °	8A	6.3	0.300	C	250 100	100 50	— 3.0 — 1.5	3.3 1.2	3.2 1.5	— —	500 350	— —	— —	NU
6A8GT	6A8G	Pentagrid Converter	8A	6.3	0.300	C	250	100	— 3	3.3	3.2	—	500	—	—	NU
6A8MG	6A7	Pentagrid Converter °	8A	6.3	0.300	C	250 100	100 50	— 3.0 — 1.5	3.3 1.2	3.2 1.5	— —	500 350	— —	— —	Replace with NU 6A8GT
6AB5	6N5	Electron Ray Tuning Indicator	6R	6.3	0.150	C	135	—	0 to — 7.5	—	—	—	—	—	—	Replace with NU 6AB5/6N5
6AB5/6N5	6AB5-6N5	Electron Ray Tuning Indicator	6R	6.3	0.150	C	135	—	0 to —10	0.5	—	—	—	—	—	NU
6AB6G	—	Power Amplifier Direct Coupled°	7W	6.3	0.500	C	250 250	Input Output	0 0	6 34	— —	— 72	— 1800	— 3500	— 8000	
‡6AB7/1853		Television Amplifier Pentode	8N	6.3	0.450	C	300	200	— 3.0	12.5	3.2	3500	5000	—	—	NU
6AC5G	—	Dynamic Coupled Amplifier	6Q	6.3	0.400	C	250	—	+13	32	—	125	3400	3700	7000	Replace with NU6AC5GT/G
6AC5GT	6AC5G	Dynamic Coupled Amplifier	6Q	6.3	0.400	C	250	—	+13	32	—	125	3400	3700	7000	Replace with NU6AC5GT/G
6AC5GT/G	6AC5G	Dynamic Coupled Amplifier	6Q	6.3	0.400	C	250	—	+13	32	—	125	3400	3700	7000	NU
6AC6G	—	Power Amplifier Direct Coupled°	7W	6.3	1.100	C	180 180	Input Output	0 0	7 45	— —	— 54	— 3000	— 3800	— 4000	
6AC6GT	—	Power Amplifier Direct Coupled	7W	6.3	1.100	C	180 180	Input Output	0	7.0 45.0	— —	— 54	— 3000	— 3600	— 3500	
‡6AC7/1852		Television Amplifier Pentode	8N	6.3	0.450	C	300	150	— 2.0	10.0	2.5	6750	9000	—	—	NU
6AD5G	—	High Mu Triode	6Q	6.3	0.300	C	250	—	— 2.0	0.9	—	100	1500	—	—	
6AD6G		Tuning Indicator	7AG	6.3	.150	C	150	—	—	3.0	—	—	—	—	—	NU
6AD7G	—	Triode-Power Amplifier Pentode	8AY	6.3	0.850	(T) C(P)	250 250	— 250	—25.0 —16.5	4.0 36.0	— 10.5	6 —	325 2500	— 3200	— 7000	
6AE5G	—	Triode Voltage Amplifier	6Q	6.3	0.300	C	95	—	—15	7.0	—	4.2	1200	—	—	Replace with NU6AE5GT/G

(Cont'd over)

Note: *(If a tube whose data is desired is not listed in this tube chart, see "Supplementary Tube Chart" on Pages 606 to 608.)*

(Cont'd)

Type Number	Similar To	Description	Base Connection	Filament Volts	Filament Amps.	Filament Type	Plate Volts	Screen Volts	Control Grid Volts	Plate Current (MA)	Screen Current (MA)	Amplification Factor	Mutual Conductance in Micromhos	Power Output in Milliwatts	Load Resistance in Ohms	
6AE5GT	6AE5G	Low Mu Triode	6Q	6.3	0.300	C	95	—	—15.0	7.0	—	4.2	1200	—	—	Replace with NU6AE5GT/G
6AE5GT/G	6AE5G	Low Mu Triode	6Q	6.3	0.300	C	95	—	—15	7.0	—	4.2	1200	—	—	NU
6AE6G		Single Grid-Twin Plate Control Tube	7AH	6.3	.150	C	250	Remote Sharp	— 1.5 — 1.5	6.5 4.5	— —	25 33	1000 950	— —	— —	NU
6AE7GT	—	Combination Driver Triode	7AX	6.3	0.500	C	250	—	—13.5	5.0	—	14	1500	—	—	NU
6AF5G	—	Triode Voltage Amplifier	6Q	6.3	0.300	C	180	—	—18	7.0	—	7.4	1500	—	—	NU
6AF6G	6AD6G	Tuning Indicator	7AG	6.3	.150	C	135	—	—	1.5	—	—	—	—	—	NU
‡6AG7	—	Video Beam Power Amplifier	8Y	6.3	0.650	C	300	300	—10.5	25.0	6.5	770	7700	—	—	
6AH5G	6L6G	Beam Power Amplifier	6AP	6.3	.9	C	350	250	—18	54	2.5	—	5200	10.8	4200	
6AH7GT	—	Double Triode	8BE	6.3	0.300	C	250	—	— 9.0	12.0	—	16	2400	—	—	
6AL6G	6L6G	Tetrode Power Amplifier	6AM	6.3	0.900	C	250	250	—14.0	72.0	5.0	—	6000	6500	2500	
6B4G	6A3	Power Amplifier Triode °	5S	6.3	1.000	F(O)	250	—	—45.0	60	—	4.2	5250	3500	2500	NU
6B5	—	Power Amplifier Direct Coupled	6AS	6.3	0.800	C	300 300	Input Output	0 0	8 45	— —	58	2400	4000	7000	NU
6B6G	75	Duplex Diode Triode°	7V	6.3	0.300	C	250	—	— 2.0	0.8	—	100	1100	—	—	NU
6B7	—	Duplex Diode Pentode	7D	6.3	0.300	C	250 100	125 100	— 3.0 — 3.0	9.0 6.8	2.3 1.7	730 285	1125 950	— —	— —	NU
6B7S	6B7	Duplex Diode Pentode	7D	6.3	0.300	C	250 100	125 100	— 3.0 — 3.0	9.0 6.8	2.3 1.7	730 285	1125 950	— —	— —	NU
‡6B8	6B7	Duplex Diode Pentode °	8E	6.3	0.300	C	250	125	— 3.0	10.0	2.3	800	1325	—	—	Replace with NU 6B8G
6B8G	6B7	Duplex Diode Pentode	8E	6.3	0.300	C	250	100	— 3.0	6.0	1.5	800	1000	—	—	NU
6B8GT	6B7	Duplex Diode Pentode	8E	6.3	0.300	C	250	125	— 3.0	10.0	2.3	—	1325	—	—	Replace with NU 6B8G
‡6C5	76	Triode Detector-Amplifier°	6Q	6.3	0.300	C	250	—	— 8.0	8	—	20	2000	—	—	Replace with NU6C5GT/G
6C5G	76	Triode Detector-Amplifier°	6Q	6.3	0.300	C	250	—	— 8.0	8	—	20	2000	—	—	Replace with NU6C5GT/G
6C5GT	6C5G	Triode Detector Amplifier	6Q	6.3	0.300	C	250	—	— 8.0	8.0	—	20	2000	—	—	Replace with NU6C5GT/G
6C5GT/G	6C5G	Triode Detector Amplifier	6Q	6.3	0.300	C	250	—	— 8.0	8.0	—	20	2000	—	—	NU
6C5MG	76	Triode Detector-Amplifier°	6Q	6.3	0.300	C	250	—	— 8.0	8	—	20	2000	—	—	Replace with NU6C5GT/G
6C6	77	Triple Grid Detector-Amplifier	6F	6.3	0.300	C	250 100	100 100	— 3.0 — 3.0	2 2	0.5 0.5	1500+ 1185	1225 1185	— —	— —	NU
6C7	85AS	Duplex Diode Triode	7G	6.3	0.300	C	250	—	— 9.0	4.5	—	20	1250	—	—	NU
6C8G	—	Double Triode°	8G	6.3	0.300	C	250	—	— 4.5	3.1	—	38	1450	—	—	NU
6D5	45	Power Amplifier Triode °	6Q	6.3	0.700	C	275	—	—40.0	31	—	4.7	2100	1400	7200	Discontinued
6D5G	45	Power Amplifier Triode °	6Q	6.3	0.700	C	275	—	—40.0	31	—	4.7	2100	1400	7200	Discontinued
6D5MG	45	Power Amplifier Triode °	6Q	6.3	0.700	C	275	—	—40.0	31	—	4.7	2100	1400	7200	Discontinued
6D8	78	Super Control R.F. Amplifier	6F	6.3	0.300	C	250	100	— 3.0	8.2	2.0	1280	1600	—	—	NU
6D7	77	Triple Grid Detector-Amplifier	7H	6.3	0.300	C	250	100	— 3.0	2	0.5	1500+	1275	—	—	NU
6D8G	6A7	Pentagrid Converter °	8A	6.3	0.150	C	135 250	67.5 100	— 3.0 — 3.0	8.0 13.0	— —	— —	325 500	— —	— —	NU
6E5	—	Electron Ray Tuning Indicator	6R	6.3	0.300	C	250	—	0 to —8	—	—	—	—	—	—	NU
6E6	—	Power Amplifier Duplex Triode	7B	6.3	0.600	C	250	—	—27.5	18	—	6	1700	1600(2)	14000(2)	NU
6E7	78	Super Control R. F. Amplifier	7H	6.3	0.300	C	250	100	— 3.0	8.2	2	1280	1600	—	—	NU
‡6F5	—	Triode-High Mu °	5M	6.3	0.300	C	250	—	— 2.0	0.9	—	100	1500	—	—	Replace with NU 6F5GT
6F5G	6F5	Triode-High Mu °	5M	6.3	0.300	C	250	—	— 2.0	0.9	—	100	1500	—	—	NU
6F5GT	6F5G	Triode High Mu	5M	6.3	0.300	C	250	—	— 2	0.9	—	100	1500	—	—	NU
6F5MG	6F5	Triode-High Mu °	5M	6.3	0.300	C	250	—	— 2.0	0.9	—	100	1500	—	—	Replace with NU 6F5GT
‡6F6	42	Power Amplifier Pentode °	7S	6.3	0.700	C	250	250	—16.5	34	6.5	200	2500	3000	7000	Replace with NU6F6GT/G
6F6G	42	Power Amplifier Pentode °	7S	6.3	0.700	C	250	250	—16.5	34	6.5	200	2500	3000	7000	Replace with NU 6F6GT/G
6F6GT	6F6G	Power Amplifier Pentode	7S	6.3	0.700	C	250	250	—16.5	34	6.5	200	2500	3000	7000	Replace with NU6F6GT/G
6F6GT/G	6F6G	Power Amplifier Pentode	7S	6.3	0.700	C	250	250	—16.5	34	6.5	200	2500	3000	7000	NU
6F6MG	42	Power Amplifier Pentode °	7S	6.3	0.700	C	250	250	—16.5	34	6.5	200	2500	3000	7000	Replace with NU6F6GT/G
6F7	—	Triode-Pentode	7E	6.3	0.300	C	100 250	(Triode) 100	— 3.0 — 3.0	3.5 6.5	— 1.5	8 900	450 1100	— —	— —	NU
6F7S	6F7	Triode-Pentode	7E	6.3	0.300	C	100 250	(Triode) 100	— 3.0 — 3.0	3.5 6.5	— 1.5	8 900	450 1100	— —	— —	NU
6F8G	—	Double Triode	8G	6.3	0.300	C	250	—	— 9	9	—	20	2600	—	—	NU
6G5	—	Electron Ray Tuning Indicator Special	6R	6.3	0.300	C	250	—	0to-22	—	—	—	—	—	—	Replace with NU 6U5/6G5
6G6G	—	Power Output Pentode	7S	6.3	0.150	C	180	180	— 9	15	2.5	400	2300	1100	10000	NU
6H4GT		Diode Rectifier	5AF	6.3	0.150	C	100	—	—	4.0	—	—	—	—	—	NU
6H5/6G5	6G5	Electron Ray Tuning Indicator	6R	6.3	0.300	C	250	—	0 to —22	—	—	—	—	—	—	Replace with NU 6U5/6G5
‡6H6	—	Duplex Diode °	7Q	6.3	0.300	C	100	—	—	2	—	—	—	—	—	Replace with NU6H6GT/G
6H6G	6H6	Duplex Diode °	7Q	6.3	0.300	C	100	—	—	2	—	—	—	—	—	Replace with NU6H6GT/G
6H6GT	6H6G	Duplex Diode	7Q	6.3	0.300	C	100	—	—	2.0	—	—	—	—	—	Replace with NU6H6GT/G
6H6GT/G	6H6G	Duplex Diode	7Q	6.3	0.300	C	100	—	—	2.0	—	—	—	—	—	NU
6H6MG	6H6	Duplex Diode	7Q	6.3	0.300	C	100	—	—	2	—	—	—	—	—	Replace with NU6H6GT/G
‡6J5	76-6C5	General Purpose Triode	6Q	6.3	0.300	C	250	—	— 8	9	—	20	2600	—	—	Replace with NU6J5GT/G
6J5G	76-6C5	General Purpose Triode	6Q	6.3	0.300	C	250	—	— 8.0	9.0	—	20	2600	—	—	Replace with NU6J5GT/G
6J5GT	6J5G	General Purpose Triode	6Q	6.3	0.300	C	250	—	— 8	9.0	—	20	2600	—	—	Replace with NU6J5GT/G
6J5GT/G	6J5G	General Purpose Triode	6Q	6.3	0.300	C	250	—	— 8	9.0	—	20	2600	—	—	NU
‡6J7	6C6-77	Triple Grid Detector-Amplifier°	7R	6.3	0.300	C	250 100	100 100	— 3.0 — 3.0	2 2	0.5 0.5	1500+ 1185	1225 1185	— —	— —	Replace with NU 6J7GT
6J7G	6C6-77	Triple Grid Detector-Amplifier°	7R	6.3	0.300	C	250 100	100 100	— 3.0 — 3.0	2 2	0.5 0.5	1500+ 1165	1225 1185	— —	— —	NU
6J7GT	6J7G	Triple Grid Detector-Amplifier	7R	6.3	0.300	C	250	100	— 3	2.0	0.5	1500+	1225	—	—	NU
6J7MG	6C6-77	Triple Grid Detector-Amplifier°	7R	6.3	0.300	C	250 100	100 100	— 3.0 — 3.0	2 2	0.5 0.5	1500+ 1185	1225 1185	— —	— —	Replace with NU 6J7GT
6J8G		Triode-Heptode Convertor	8H	6.3	0.300	Tri. C Hep. C	250 250	— 100	— — 3	5.0 1.3	— 2.9	— —	— 290	— —	— —	NU
6K5G	6F5	High Mu Triode °	5U	6.3	0.300	C	250	—	— 3.0	1.1	—	70	1400	—	—	NU

Note: *(If a tube whose data is desired is not listed in this tube chart, see "Supplementary Tube Chart" on Pages 606 to 608.)*

(Cont'd)

(Cont'd)

Type Number	Similar To	Description	Base Connection	Filament Volts	Filament Amps.	Filament Type	Plate Volts	Screen Volts	Control Grid Volts	Plate Current (MA)	Screen Current (MA)	Amplification Factor	Mutual Conductance in Micromhos	Power Output in Milliwatts	Load Resistance in Ohms	
6K5GT	6K5G	Triode High Mu	5U	6.3	0.300	C	250	—	— 8	1.1	—	70	1400	—	—	NU
6K6G	41	Power Amplifier Pentode °	7S	6.3	0.400	C	250	250	—18.0	32.0	5.5	150	2200	3400	7600	Replace with NU6K6GT/G
6K6GT	6K6G	Power Amplifier Pentode	7S	6.3	0.400	C	250	250	—18	32	5.5	150	2200	3400	7600	Replace with NU6K6GT/G
6K6GT/G	6K6G	Power Amplifier Pentode	7S	6.3	0.400	C	250	250	—18	32	5.5	150	2200	3400	7600	NU
‡6K7	6D6-78	Super Control R.F. Amplifier °	7R	6.3	0.300	C	250 90	100 90	— 3.0 — 3.0	7.8 5.4	1.7 1.3	1160 400	1450 1275	—	—	Replace with NU 6K7GT
6K7G	6D6-78	Super Control R.F. Amplifier °	7R	6.3	0.300	C	250 90	100 90	— 3.0 — 3.0	7.8 5.4	1.7 1.3	1160 400	1450 1275	—	—	NU
6K7GT	6K7G	Super Control R.F. Amplifier	7R	6.3	0.300	C	250	125	— 3	10.5	2.6	990	1650	—	—	NU
6K7MG	6D6-78	Super Control R.F. Amplifier °	7R	6.3	0.300	C	250 90	100 90	— 3.0 — 3.0	7.8 5.4	1.7 1.3	1160 400	1450 1275	—	—	Replace with NU 6K7GT
‡6K8		Triode-Hexode Converter	8K	6.3	0.300	Tri. 100 C Hex.250	—	100	— — 3.0	3.8 2.5	— 6.0	— —	— —	— (Triode Grid 300 Resistor 50000 Ohms)		Replace with NU 6K8GT
6K8G	6K8	Triode-Hexode Converter	8K	6.3	0.300	Tri. 100 C Hex.250	—	100	— — 3.0	3.8 2.5	— 6.0	— —	— —	— (Triode Grid 300 Resistor 50000 Ohms)		NU
6K8GT	6K8G	Triode-Hexode Converter	8K	6.3	0.300	Tri. 100 C Hex. 250	—	100	— — 3	3.8 2.3	— 6.0	— —	— 350	— —	— —	NU
6L5G	76	Triode Detector-Amplifier °	6Q	6.3	0.150	C	135 250	—	— 5.0 — 9.0	3.5 8.0	— —	17 17	1500 1900	—	—	NU
‡6L6	—	Beam Power Amplifier °	7AC	6.3	0.900	C	250	250	—14.0	72	5.0	135	6000	6500	2500	Replace with NU 6L6G
6L6G	6L6	Beam Power Amplifier °	7AC	6.3	0.900	C	250	250	—14.0	72	5.0	135	6000	6500	2500	NU
‡6L7	—	Pentagrid Mixer Amplifier °	7T	6.3	0.300	C	250	100	— 3.0	5.3	5.5	880	1100	—	—	Replace with NU 6L7G
6L7G	6L7	Pentagrid Mixer Amplifier °	7T	6.3	0.300	C	250	100	— 3.0	5.3	5.5	880	1100	—	—	NU
6L7MG	6L7	Pentagrid Mixer Amplifier °	7T	6.3	0.300	C	250	100	— 3.0	5.3	5.5	880	1100	—	—	Replace with NU 6L7G
6N5	6G5	Electron Ray Tuning Indicator	6R	6.3	0.150	C	135	—	0 to 12	0.5	—	—	—	—	—	Replace with NU6AB5/6N5
6N6G	6B5	Power Amplifier Direct Coupled °	7W	6.3	0.800	C	250 250	— —	0	6.5 33.0	— —	— —	— —	2500	7000	NU
6N6MG	6B5	Power Amplifier Direct Coupled °	7W	6.3	0.800	C	250 250	— —	0	6.5 33.0	— —	— —	— —	2500	7000	Replace with NU6N6G
‡6N7	6A6	Class B Twin Amplifier °	8B	6.3	0.800	C	300	—	0	17.5	—	—	—	10000	10000	Replace with NU6N7GT/G
6N7G	6A6	Class B Twin Amplifier °	8B	6.3	0.800	C	300	—	0	17.5	—	—	—	10000	10000	Replace with NU6N7GT/G
6N7GT/G	6A6	Class B Twin Amplifier °	8B	6.3	0.800	C	300	—	0	17.5	—	—	—	10000	10000	NU
6N7MG	6A6	Class B Twin Amplifier °	8B	6.3	0.800	C	300	—	0	17.5	—	—	—	10000	10000	Replace with NU6N7GT/G
6P5G	76	General Purpose Triode	6Q	6.3	0.300	C	250	—	—13.5	5.0	—	13.8	1450	—	—	Replace with NU6P5GT/G
6P5GT	76	General Purpose Triode	6Q	6.3	0.300	C	250	—	—13.5	5.0	—	13.8	1450	—	—	Replace with NU6P5GT/G
6P5GT/G	76	General Purpose Triode °	6Q	6.3	0.300	C	250	—	—13.5	5.0	—	13.8	1450	—	—	NU
6P7G	6F7	Triode-Pentode °	7U	6.3	0.300	C	100 250	(Triode) 100	— 3.0 — 3.0	3.5 6.5	— 1.5	8 900	450 1100	—	—	NU
6Q6G	—	Single Diode Triode °	6Y	6.3	0.150	C	135 250	— —	— 1.5 — 3.0	0.9 1.2	— —	65 65	1000 1050	—	—	Replace with NU6Q6G/6T7G
6Q6G/6T7G	75	Duplex Diode Triode°	7V	6.3	0.150	C	250	—	— 3.0	1.2	—	65	1050	—	—	Replace with NU6T7G
‡6Q7	75	Duplex Diode-Triode °	7V	6.3	0.300	C	250	—	— 3.0	1.1	—	70	1200	—	—	Replace with NU 6Q7GT
6Q7G	75	Duplex Diode Triode °	7V	6.3	0.300	C	250	—	— 3.0	1.1	—	70	1200	—	—	NU
6Q7GT	6Q7G	Duplex Diode Triode	7V	6.3	0.300	C	250	—	— 3.0	1.1	—	70	1200	—	—	NU
6Q7MG	75	Duplex Diode-Triode °	6S	6.3	0.300	C	250	—	— 3.0	1.1	—	70	1200	—	—	Replace with NU 6Q7GT
6R6G	—	Pentode Voltage Amplifier	6AW	6.3	0.300	C	250	100	— 3.0	7.9	1.7	1160	1450	—	—	
‡6R7	—	Duplex Diode Triode °	7V	6.3	0.300	C	250	—	— 9.0	9.5	—	16	1900	275	10000	Replace with NU 6R7GT
6R7G	—	Duplex Diode Triode °	7V	6.3	0.300	C	250	—	— 9.0	9.5	—	16	1900	275	10000	NU
6R7GT	6R7G	Duplex Diode Triode	7V	6.3	0.300	C	250	—	— 9.0	9.5	—	16	8500	—	—	NU
6R7MG	6R7	Duplex Diode Triode °	7V	6.3	0.300	C	250	—	— 9.0	9.5	—	16	1900	275	10000	Replace with NU 6R7GT
6S6GT	—	Super Control R.F. Amplifier	5AK	6.3	0.450	C	250	100	— 2.0	13.0	3.0	1400	4000	—	—	
‡6S7		Super Control R.F. Amplifier	7R	6.3	0.150	C	250	100	— 3	8.5	2.0	1750	1750	—	—	Replace with NU 657G
6S7G	6D6	Super Control R.F. Amplifier°	7R	6.3	0.150	C	135 250	67.5 100	— 3.0 — 3.0	3.7 8.5	0.9 2.0	850 min. 1100 min.	1250 1750	—	—	NU.
‡6SA7	—	Pentagrid Converter	8R	6.3	0.300	C	250	100	— 2.0	3.4	8	—	450	—	—	Replace with NU6SA7GT/G
6SA7GT	6SA7	Pentagrid Converter	8AD	6.3	0.300	C	250	100	— 2.0	3.4	8.0	—	450	—	—	Replace with NU6SA7GT/G
6SA7GT/G	6SA7	Pentagrid Converter	8AD	6.3	0.300	C	250	100	— 2.0	3.4	8	—	450	—	—	NU
‡6SC7	—	Twin Triode Amplifier	8S	6.3	0.300	C	250	—	— 2.0	2.0	—	70	1325	—	—	Replace with NU 6SC7GT
6SC7GT	6SC7	Twin Triode Amplifier	8S	6.3	.3	C	250	—	— 2	2	—	70	1325	—	—	NU
6SD7GT	—	Semi-remote Cutoff R. F. Amplifier	8N	6.3	0.300	C	250	100	— 2.0	6.0	1.9	—	3600	—	—	NU
6SE7GT	6SJ7GT	Triple Grid Amplifier	8N	6.3	0.300	C	250	100	— 1.5	4.5	1.5	—	3400	—	—	
‡6SF5	6F5	High Mu Triode	6AB	5.3	0.300	C	250	—	— 2	0.9	—	100	1500	—	—	Replace with NU6SF5GT/G
6SF5GT	6F5GT	High Mu Triode	6AB	6.3	0.300	C	250	—	— 2.0	0.9	—	100	1500	—	—	Replace with NU6SF5GT/G
6SF5GT/G	6F5GT	High Mu Triode	6AB	6.3	0.300	C	250	—	— 2.0	0.9	—	100	1500	—	—	NU
‡6SF7	—	Diode Pentode	7AZ	6.3	0.300	C	250	100	— 1.0	12.4	3.3	—	2050	—	—	NU
‡6SG7	—	Super Control R. F. Pentode	8BC	6.3	0.300	C	250	150	— 2.5	9.2	3.4	—	4000	—	—	NU
‡6SH7	—	H.F Amplifier Pentode	8BK	6.3	.3	C	250	150	— 1	10.8	4.1	—	4900	—	—	
‡6SJ7	6J7	Triple Grid Detector-Amplifier	8N	6.3	.300	C	250	100	— 3	3.0	0.8	2500	1650	—	—	Replace with NU6SJ7GT/G
6SJ7GT	6J7G	Triple Grid Detector Amplifier	8N	6.3	0.300	C	250	100	— 3.0	3.0	0.8	2500	1650	—	—	Replace with NU6SJ7GT/G
6SJ7GT/G	6J7G	Triple Grid Detector Amplifier	8N	6.3	0.300	C	250	100	— 3.0	3.0	0.8	2500	1650	—	—	NU
‡6SK7	6K7	Super Control R. F. Amplifier	8N	6.3	.300	C	250	100	— 3	9.2	2.4	1600	2000	—	—	Replace with NU6SK7GT/G
6SK7GT	6K7G	Super Control R.F. Amplifier	8N	6.3	0.300	C	250	100	— 3.0	9.2	2.4	1600	2000	—	—	Replace with NU6SK7GT/G
6SK7GT/G	6K7G	Super Control R. F. Amplifier	8N	6.3	0.300	C	250	100	— 3.0	9.2	2.4	1600	2000	—	—	NU
6SL7GT	6C8G	Twin Triode Amplifier	8BD	6.3	0.300	C	250	—	— 2.0	2.3	—	70	1600	1000	—	
6SN7GT	6F8G	Twin Triode Amplifier	8BD	6.3	0.600	C	300	—	— 8.0	9.0	—	20	2600	2500	—	NU
‡6SQ7	75	Duplex Diode-Triode	8Q	6.3	.300	C	250	—	— 2	0.8	—	100	1100	—	—	Replace with NU6SQ7GT/G
6SQ7G	6SQ7	Duplex Diode Triode	8Q	6.3	0.300	C	250	—	— 2.0	0.8	—	100	1100	—	—	Replace with NU6SQ7GT/G
6SQ7GT	6Q7G	Duplex Diode Triode	8Q	6.3	0.300	C	250	—	— 2.0	0.8	—	100	1100	—	—	Replace with NU6SQ7GT/G

Note: *(If a tube whose data is desired is not listed in this tube chart, see "Supplementary Tube Chart" on Pages 606 to 608.)*

(Cont'd over)

(Cont'd)

Type Number	Similar To	Description	Base Connection	Filament Volts	Filament Amps	Filament Type	Plate Volts	Screen Volts	Control Grid Volts	Plate Current (MA)	Screen Current (MA)	Amplification Factor	Mutual Conductance in Micromhos	Power Output in Milliwatts	Load Resistance in Ohms	
6SQ7GT/G	6Q7G	Duplex Diode Triode	8Q	6.3	0.300	C	250	—	— 2.0	0.8	—	100	1100	—	—	NU
‡6SR7	6R7	Duplex Diode Triode	8Q	6.3	0.300	C	250	—	— 9.0	9.5	—	16	1900	—	—	NU
‡6SS7	—	Super Control R. F. Amplifier	8N	6.3	0.150	C	250	100	— 3.0	9.0	2.0	—	1850	—	—	NU
‡6ST7	—	Duplex-Diode Triode	8Q	6.3	.15	C	250	—	— 9	9.5	—	16	1900	—	—	
6T5	—	Electron Ray Tuning Indicator	6R	6.3	0.300	°C	250	—	0 to —22	—	—	—	—	—	—	Replace with NU6U5/6G5
6T7G	75	Duplex Diode-Triode©	7V	6.3	0.150	C	250	—	— 3	1.2	—	65	1050	—	—	NU
6U5	6G5	Electron Ray Tuning Indicator	6R	6.3	0.300	C	250	—	0 to —22	—	—	—	—	—	—	Replace with NU 6U5/6G5
6U5/6G5	6U5	Tuning Indicator	6R	6.3	0.300	C	250	—	0 to —22	—	—	—	—	—	—	NU
6U6GT	—	Beam Power Amplifier	7AC	6.3	0.750	C	135	135	—13.5	60.0	15.0	—	6200	3300	2000	NU
6U7G	6D6	Super Control R.F. Amplifier©	7R	6.3	0.300	C	250	100	— 3	8.2	2.0	1250	1600	—	—	NU
‡6V6	—	Beam Power Amplifier	7AC	6.3	0.450	C	250	250	—12.5	45	4.5	218	4100	4250	5000	Replace with NU6V6GT/G
6V6G	—	Beam Power Amplifier ©	7AC	6.3	0.450	C	250	250	—12.5	45	4.5	218	4100	4250	5000	Replace with NU 6V6GT/G
6V6GT	6V6G	Beam Power Amplifier	7AC	6.3	0.450	C	250	250	—12.5	47	6.5	—	—	4250	5000	Replace with NU6V6GT/G
6V6GT/G	6V6G	Beam Power Amplifier	7AC	6.3	0.450	C	250	250	—12.5	47	6.5	—	—	4250	5000	NU
6V7G	85	Duplex Diode-Triode ©	7V	6.3	0.300	C	250	—	—20	8.0	—	8.3	1100	350	20000	NU
6W5G	6X5G	Full Wave Rectifier*	6S	6.3	0.300	C	350	—	—	100	—	—	—	—	—	NU
6W6GT	6L6G	Beam Power Amplifier	7AC	6.3	1.250	C	135	135	— 9.5	81	12.0	215	9000	3300	2000	
6W7G	6J7G	Triple Grid Detector-Amplifier	7R	6.3	0.150	C	250	100	— 3	2.0	0.5	1850	1225	—	—	NU
‡6X5	84	Full Wave Rectifier ©	6S	6.3	0.600	C	350	—	—	75	—	—	—	—	—	Replace with NU6X5GT/G
6X5G	84	Full Wave Rectifier ©	6S	6.3	0.600	C	350	—	—	75	—	—	—	—	—	Replace with NU6X5GT/G
6X5GT	84	Full Wave Rectifier	6S	6.3	0.600	C	350	—	—	75	—	—	—	—	—	Replace with NU6X5GT/G
6X5GT/G	84	Full Wave Rectifier©	6S	6.3	0.600	C	350	—	—	75	—	—	—	—	—	NU
6X5MG	84	Full Wave Rectifier ©	6S	6.3	0.600	C	350	—	—	75	—	—	—	—	—	Replace with NU6X5GT/G
6Y3G	—	Half Wave Rectifier	4AC	6.3	.7	C	5000a.c.	—	—	7.5	—	—	—	—	—	NU
6Y5	84	Full Wave Rectifier *.	6J	6.3	0.800	C	350	—	—	50	—	—	—	—	—	Replace with NU 6Y5V
6Y5V	84	Full Wave Rectifier	6J	6.3	0.800	C	350	—	—	60	—	—	—	—	—	NU
6Y6G	—	Power Amplifier Tetrode	7AC	6.3	1.250	C	135	135	—13.5	38	3	—	7000	3600	2000	NU
6Y6GT	6Y6G	Power Amplifier Tetrode	7AC	6.3	1.250	C	135	135	—13.5	60	3.0	—	7000	3600	2000	Replace with NU 6Y6G
6Y7G	79	Class B Twin Amplifier©	8B	6.3	0.600	C	250	—	0	10.5	—	—	8000	14000		NU
6Z3	1V	Half Wave Rectifier	4G	6.3	0.300	C	350	—	—	50	—	—	—	—	—	Replace with NU1V
6Z4-84	84	Full Wave Rectifier	5D	6.3	0.500	C	350	—	—	50	—	—	—	—	—	
6Z5	—	Full Wave Rectifier	6K	6.3	0.600	C	250	—	—	68	—	—	—	—	—	NU
6Z6MG	84	Full Wave Rectifier ©	7Q	6.3	0.500	C	350	—	—	60	—	—	—	—	—	
6Z7G	—	Class B Twin Amplifier	8B	6.3	0.300	C	180	—	0	—	—	—	—	4200	12000(P.P.)	NU
6ZY5G	—	Full Wave Rectifier	6S	6.3	0.300	C	350	—	—	35	—	—	—	—	—	NU
† 7A4	6J5G	General Purpose Triode	5AC	7.0	0.320	C	250	—	— 8	9.0	—	20	2600	—	—	NU
† 7A5		Power Output Pentode	6AA	7.0	0.750	C	125	125	— 9.0	37.5	3.2	—	6100	1900	3700	NU
† 7A6	—	Duplex Diode	7AJ	7.0	.160	C	150	R.M.S. Max	—	10 Max.	—	—	—	—	—	NU
† 7A7	—	Super Control R. F. Amplifier	8V	7.0	0.320	C	250	100	— 3.0	8.6	2.0	1600	2000	—	—	NU
‡7A7LM	7A7	Super Control R.F. Amplifier	8V	6.3	0.300	C	250	100	— 3.0	8.6	2.0	—	2000	—	—	Replace with NU 7A7
† 7A8	—	Octode Converter	8U	7.0	0.160	C	250	100	— 3.0	3.0	2 8	—	600	—	—	NU
† 7B4	—	High Mu Triode	5AC	7.0	0.320	C	250	—	— 2.0	0.9	—	100	1500	—	—	NU
† 7B5	—	Pentode Power Amplifier	6AE	7.0	0.430	C	250	250	—18.0	32	5.5	150	2200	3400	7600	NU
7B5LT	7B5	Power Amplifier Pentode	6AE	7.0	0.430	C	250	250	—18.0	32.0	5.5	150	2300	3400	7600	Replace with NU 7B5
† 7B6	—	Duo Diode Triode	8W	7.0	0.320	C	250	—	— 2.0	1.0	—	100	1100	—	—	NU
‡7B6LM	7B6	Duplex Diode-Triode	8W	7.0	0.320	C	250	—	— 2.0	0.9	—	100	1100	—	—	Replace with NU 7B6
† 7B7	—	Super Control R. F. Amplifier	8V	7.0	0.160	C	250	100	— 3.0	8.5	2.0	1200	1700	—	—	NU
† 7B8	—	Pentagrid Converter	8X	7.0	0.320	C	250	100		3.5	2.7	—	550	—	—	NU
‡7B8LM	7B8	Pentagrid Converter	8X	7.0	0.320	C	250	100	— 3.0	3.5	2.7	—	550	—	—	Replace with NU 7B8
† 7C5	—	Tetrode Power Amplifier	6AA	7.0	0.480	C	250	250	—12.5	45	4.5	—	4100	4250	5000	NU
7C5LT	7C5	Tetrode Power Amplifier	6AA	7.0	0.480	C	250	250	—12.5	47.0	7.0	—	4100	4500	5000	Replace with NU 7C5
† 7C6	—	Duo Diode High Mu Triode	8W	7.0	0.160	C	250	—	—	1.3	—	100	1000	—	—	NU
† 7C7	6W7G	Triple Grid Detector-Amplifier	8V	7.0	0.160	C	250	100	— 3	2.0	0.5	—	1300	—	—	NU
† 7E6	6R7G	Duplex Diode-Medium Mu Triode	8W	7.0	0.320	C	250	—	— 9	9.5	—	16	1900	—	—	NU
† 7E7		Duplex Diode Pentode	8AE	7.0	0.320	C	250	100	— 3.0	7.5	1.6	—	1300	—	—	NU
† 7F7		Double Triode Amplifier	8AC	7.0	0.320	C	250	—	— 2.0	2.3	—	70	1600	—	—	NU
† 7G7/1232	—	Triple Grid Amplifier	8V	7.0	0.480	C	250	100	— 2.0	6.0	2.0	—	4500	—	—	NU
† 7H7	—	Semi-Remote Cutoff Amplifier	8V	7.0	0.320	C	250	150	— 2.5	9.0	2.5	—	3500	—	—	NU
† 7J7		Triode Hexode Converter	8AR	7.0	0.320	C	250	100	— 3.0	1.4	2.8	—	310	—	—	
						Tri.	150	—	— 3.0	7.5	—	14	1350	—	—	NU
† 7K7	—	Duplex-Diode High-Mu Triode	8BF	6.3	.3	C	250	—	— 2	2.3	—	70	1600	—	—	
† 7L7	—	R.F Pentode	8V	7.0	0.320	C	250	100	— 1.5	4.5	1.5	—	3100	—	—	NU
† 7N7	6F8G	Double Triode Amplifier	8AC	7.0	0.640	C	250	—	— 8.0	9.0	—	20	2600	—	—	NU
† 7Q7	—	Pentagrid Converter	8AL	7.0	0.320	C	250	100	0	3.4	5.0	—	450	—	—	NU
† 7R7		Duplex Diode Pentode	8AE	7.0	0.320	C	250	100	— 1.0	5.7	2.1	—	3200	—	—	
† 7S7		Triode-Hexode Converter	8AR	7.0	0.320	C	250	100	— 2.0	1.7	0.4	—	600	—	—	
						Tri.	100	—	0	7.0	—	18	1700	—	—	NU
† 7V7		R. F. Pentode	8V	7.0	0.480	C	300	150	(— 2.0)	9.6	3.9	—	5800	—	—	NU
† 7W7	7V7	Amplifier Pentode	8BJ	6.3	.45	C	300	150	— 2	10.0	3.9	—	5800	—	—	
† 7Y4	—	Full Wave Rectifier	5AB	7.0	0.530	C	350	—	—	60	—	—	—	—	—	NU
† 7Z4	—	Full Wave Rectifier	5AB	7.0	0.960	C	325	—	—	100	—	—	—	—	—	NU
7	—	Ballast Tube	4A	176.0	0.300	F	—	—	—	—	—	—	—	—	—	
8	—	Ballast Tube	4A	132.0	0.300	F	—	—	—	—	—	—	—	—	—	
9	—	Ballast Tube	4A	90.0	0.300	F	—	—	—	—	—	—	—	—	—	
10	—	Power Amplifier Triode	4D	7.5	1.250	F(OT)	425	—	—30.0	18	—	8	1600	1600	10200	NU
WD11	⊕WX12	Triode Detector-Amplifier	4F	1.1	0.250	F(O)	135	—	—10.5	3	—	6.6	440	—	—	Obsolete
WX12	WD11	Triode Detector-Amplifier	4D	1.1	0.250	F(O)	135	—	—10.5	3	—	6.6	440	—	—	Obsolete

Note: (*If a tube whose data is desired is not listed in this tube chart, see "Supplementary Tube Chart" on Pages 606 to 608.*)

(Cont'd)

Receiving Tube Operating Characteristics and Basing Diagram Charts

(Cont'd)

Type Number	Similar To	Description	Base Connection	Filament Volts	Filament Amps.	Filament Type	Plate Volts	Screen Volts	Control Grid Volts	Plate Current (MA)	Screen Current (MA)	Amplification Factor	Mutual Conductance in Micromhos	Power Output in Milliwatts	Load Resistance in Ohms	
12A	—	Triode Detector-Amplifier	4D	5.0	0.250	F(O)	180 90	— —	—13.5 — 4.5	7.7 5.0	— —	8.5 8.5	1800 1575	1285 35	10650 5000	NU
12A5	—	Power Amplifier Pentode	7F	6.3 12.6	0.600 0.300	C	180	180	—27.0	38	8	90	2300	2600	3800	NU
‡ 12A6	—	Beam Power Amplifier	7AC	12.6	0.150	C	250	250	—12.5	30.0	3.5	—	3000	2500	7500	
12A7	—	Pentode and Half Wave Rectifier	7K	12.5	0.300	C	135 125	135 —	—13.5 —	9 30	2.5 —	100 —	975 —	— —	— —	
12A8G	6A8G	Pentagrid Converter	8A	12.5	0.150	C	250	100	— 3.0	3.5	2.7	—	550	—	—	Replace with NU 12A8GT
12A8GT	6A8G	Pentagrid Converter	8A	12.5	0.150	C	250	100	— 3	3.3	3.2	—	500	—	—	NU
12AH7GT		Double Triode	8BE	12.6	0.150	C	250	—	— 9.0	12.0	—	16	2400	—	—	
12B7	—	Super Control R.F. Amplifier	8V	12.6	0.150	C	250	100	— 3.0	9.2	2.4	—	2000	—	—	Replace with NU 14A7/12B7
12B7ML	—	Super Control R.F. Amplifier	8V	12.6	0.150	C	250	100	— 3.0	9.2	2.4	—	2000	—	—	Replace with NU 14A7/12B7
12B8GT	—	Triode Pentode	8T	12.6	0.300	C	P90 T90	90 —	— 3.0 0	7.0 2.8	2.0 —	360 90	1800 2400	— —	— —	NU
12C8	—	Duo Diode Pentode	8E	12.6	0.150	C	250	125	— 3.0	10.0	2.3	800	1325	—	—	NU
12E5GT	6P5G	General Purpose Triode	6Q	12.6	0.150	C	250	—	—13.5	5.0	—	13.8	1450	—	—	Replace with NU12E5GT/G
12E5GT/G	6P5G	General Purpose Triode	6Q	12.6	0.150	C	250	—	—13.5	5.0	—	13.8	1450	—	—	NU
12F5GT	6F5G	High Mu Triode	5M	12.5	0.150	C	250	—	— 2.0	0.9	—	100	1500	—	—	NU
‡12H6	6H6	Duplex Diode	7Q	12.6	0.150	C	150	—	—	8.0	—	—	—	—	—	
12J5GT	6J5G	General Purpose Triode	6Q	12.6	0.150	C	250	—	— 8	9.0	—	20	2600	—	—	NU
12J7G	12J7GT	Triple Grid Detector Amplifier	7R	12.6	0.150	C	250	100	— 3.0	2.0	0.5	1500	1225	—	—	Replace with NU 12J7GT
12J7GT	6J7G	Triple Grid Detector Amplifier	7R	12.5	0.150	C	250	100	— 3.0	2.0	0.5	1500	1225	—	—	NU
12K7G	6K7G	Super Control R.F. Amplifier	7R	12.5	0.150	C	250	125	— 3.0	10.5	2.6	990	1650	—	—	Replace with NU 12K7GT
12K7GT	6K7G	Super Control R. F. Amplifier	7R	12.5	0.150	C	250	100	— 3.0	7.0	1.7	1160	1450	—	—	NU
‡12K8	6K8	Triode Hexode Converter	8K	12.6	0.150	(T) C(H)	100 250	— 100	— — 3.0	3.8 2.5	— 6.0	Triode Grid Resister 50,000 Ohms —	350	—	—	Replace with NU 12K8GT
12K8GT	—	Triode Hexode Converter	8K	12.6	0.150	C	T100 H250	— 100	0 — 3.0	3.8 2.5	— 6.0	—	350	—	—	NU
12Q7G	6Q7G	Duplex Diode High Mu Triode	7V	12.5	0.150	C	250	—	— 3.0	1.1	—	70	1200	—	—	Replace with NU 12Q7GT
12Q7GT	6Q7G	Duo Diode High Mu Triode	7V	12.5	0.150	C	250	—	— 3.0	1.1	—	70	1200	—	—	NU
‡12SA7	—	Pentagrid Converter	8R	12.6	0.150	C	250	100	— 2.0	3.4	8.0	—	450	—	—	Replace w. NU12SA7GT/G
12SA7G	12SA7-12SA7GT	Pentagrid Converter	8AD	12.6	0.150	C	250	100	— 2.0	3.4	8.0	—	450	—	—	Replace w. NU12SA7GT/G
12SA7GT	6SA7	Pentagrid Converter	8AD	12.6	0.150	C	250	100	— 2	3.4	8.0	—	450	—	—	Replace w NU12SA7GT/G
12SA7GT/G	6SA7	Pentagrid Converter	8AD	12.6	0.150	C	250	100	— 2	3.4	8.0	—	450	—	—	NU
‡12SC7	—	Twin Triode Amplifier	8S	12.6	0.150	C	250	—	— 2.0	2.0	—	70	1325	—	—	NU
‡12SF5	12SF5GT	High Mu Triode	6AB	12.6	0.150	C	250	—	— 2.0	0.9	—	100	1500	—	—	Replace w. NU12SF5GT/G
12SF5GT	6F5G	High Mu Triode	6AB	12.6	0.150	C	250	—	— 2.0	0.9	—	100	1500	—	—	Replace w. NU12SF5GT/G
12SF5GT/G	6F5G	High Mu Triode	6AB	12.6	0.150	C	250	—	— 2.0	0.9	—	100	1500	—	—	NU
‡12SF7	6SF7	Diode Pentode	7AZ	12.6	0.150	C	250	100	— 1.0	12.4	3.3	—	2050	—	—	NU
‡12SG7	6SG7	Super Control R. F. Pentode	8BC	12.6	0.150	C	250	150	— 2.5	9.2	3.4	—	—	—	4000	NU
‡12SH7	6SH7	H.F. Amplifier Pentode	8BK	12.6	0.150	C	250	150	— 1	10.8	4.1	—	4900	—	—	
‡12SJ7	—	Triple Grid Detector-Amplifier	8N	12.6	0.150	C	250	100	— 3.0	3.0	0.8	2500	1650	—	—	Replace w. NU12SJ7GT/G
12SJ7GT	6J7G	Triple Grid Detector Amplifier	8N	12.6	0.150	C	250	100	— 3.0	3.0	0.8	2500	1650	—	—	Replace w. NU12SJ7GT/G
12SJ7GT/G	6J7G	Triple Grid Detector Amplifier	8N	12.6	0.150	C	250	100	— 3.0	3.0	0.8	2500	1650	—	—	NU
‡12SK7	—	Super Control R. F. Amplifier	8N	12.6	0.150	C	250	100	— 3.0	9.2	2.4	1600	2000	—	—	Replace w. NU12SK7GT/G
12SK7GT	6K7G	Super Control R.F. Amplifier	8N	12.6	0.150	C	250	100	— 3.0	9.2	2.4	1600	2000	—	—	Replace w. NU12SK7GT/G
12SK7GT/G	6K7G	Super Control R. F. Amplifier	8N	12.6	0.150	C	250	100	— 3.0	9.2	2.4	1600	2000	—	—	NU
12SL7GT	6SL7GT	Twin Triode Amplifier	8BD	12.6	0.150	C	250	—	— 2.0	2.3	—	70	1600	1000	—	NU
12SN7GT	6SN7GT	Twin Triode Amplifier	8BD	12.6	0.300	C	300	—	— 8.0	9.0	—	20	2600	2500	—	
‡12SQ7	—	Duo Diode High Mu Triode	8Q	12.6	0.150	C	250	—	— 2.0	0.8	—	100	1100	—	—	Replace w. NU12SQ7GT/G
12SQ7GT	6Q7G	Duplex Diode High Mu Triode	8Q	12.6	0.150	C	250	—	— 2.0	0.8	—	100	1100	—	—	Replace w. NU12SQ7GT/G
12SQ7GT/G	6Q7G	Duplex Diode High Mu Triode	8Q	12.6	0.150	C	250	—	— 2.0	0.8	—	100	1100	—	—	NU
‡12SR7	6H7	Duplex Diode Triode	8Q	12.6	0.150	C	250	—	— 8.0	8.5	—	16	1900	—	—	NU
12Z3	—	Half Wave Rectifier	4G	12.6	0.500	C	250	—	—	90	—	—	—	—	—	NU
12Z5	—	Voltage Doubling Rectifier	7L	12.6	0.500	C	225	—	—	80	—	—	—	—	—	
12Z5-6Z5	—	Full Wave Rectifier	6K	12.6	0.500	C	225	—	—	60	—	—	—	—	—	
14	—	Screen Grid R.F. Amplifier	5E	14.0	0.500	C	250	90	— 3.0	4	1.5	525	1050	—	—	
†14A4	7A4	Detector Amplifier Triode	5AC	12.6	0.150	C	250	—	— 8.0	9.0	—	20	2600	—	—	NU
†14A5	7A5	Beam Power Amplifier	6AA	12.6	0.150	C	250	250	—12.5	32.0	5.0	—	3000	2500	7500	
†14A7/12B7	7A7	Super Control R. F. Amplifier	8V	12.6	0.150	C	250	100	— 3.0	9.2	2.6	—	2000	—	—	NU
†14AF7	—	Twin Triode Amplifier	8AC	12.6	0.150	C	250	—	—10.0	9.0	—	16	2100	—	—	
†14B6	7B6	Duplex Diode Triode	8W	14.0	0.150	C	250	—	— 2.0	0.9	—	100	1100	—	—	
†14B8	B8	Pentagrid Converter	8X	12.6	0.150	C	250	100	— 3.0	3.5	2.7	—	550	—	—	
†14C5	7C5	Beam Power Amplifier	8AA	12.6	0.225	C	250	250	—12.5	47.0	7.0	—	4100	4500	5000	
†14C7	7C7	Triple Grid Detector Amplifier	8V	12.6	0.150	C	250	100	— 3.0	2.2	0.7	—	1575	—	—	NU
†14E6	7E6	Duplex Diode Medium Mu Triode	8W	12.6	0.150	C	250	—	— 9.0	9.5	—	16	1900	—	—	
†14E7	7E7	Duplex Diode Pentode	8AE	12.6	0.150	C	250	100	— 3.0	7.5	1.6	—	1300	—	—	
†14F7	7F7	Double Triode Amplifier	8AC	12.6	0.150	C	250	—	— 2.0	2.3	—	70	1600	—	—	
†14H7	7H7	Semi-remote Cutoff Amplifier	8V	12.6	0.150	C	250	150	— 2.5	9.5	3.5	—	3800	—	—	NU
†14J7	7J7	Triode Hexode Converter	8AR	12.6	0.150	C	250 150	100 (Triode)	— 3.0 — 3.0	1.4 7.5	2.8 —	— 14	310 1350	— —	— —	NU
†14N7	7N7	Double Triode Amplifier	8AC	12.6	0.300	C	250	—	— 5.5	2.4	—	20	2600	—	—	
†14Q7	7Q7	Pentagrid Converter	8AL	12.6	0.150	C	250	100	— 2.0	3.5	8.5	—	550	—	—	NU
†14R7	7R7	Duplex Diode Pentode	8AE	12.6	0.150	C	250	100	— 1.0	5.7	2.1	—	3200	—	—	NU
†14S7	7S7	Triode Heptode Converter	8BL	12.6	.15	C	250	100	— 2	1.8	3.0	—	525	—	—	
†14W7	7W7	Amplifier Pentode	8BJ	12.6	.225	TRI. C	100 300	— 150	— 0 — 2	6.5 10.0	— 3.9	18 —	1650 5800	— —	— —	
†14Y7	7Y4	Full Wave Rectifier	5AB	12.6	0.300	C	325	—	—	70.0	—	—	—	—	—	NU
†14Z3	12Z3	Half Wave Rectifier	4G	14.0	0.300	C	250	—	—	60	—	—	—	—	—	Replace with NU12Z3

Note: (*If a tube whose data is desired is not listed in this tube chart, see "Supplementary Tube Chart" on Pages 606 to 608.*)

(Cont'd over)

(Cont'd)

Type Number	Similar To	Description	Base Connection	Filament Volts	Filament Amps.	Filament Type	Plate Volts	Screen Volts	Control Grid Volts	Plate Current (MA)	Screen Current (MA)	Amplification Factor	Mutual Conductance in Micromhos	Power Output in Milliwatts	Load Resistance in Ohms	
15	32	Screen Grid R.F. Amplifier	5F	2.0	0.220	C	67.5	67.5	— 1.5	1.8	0.3	450	710	—	—	NU
17	—	Triode General Purpose	5A	14.0	0.300	C	180	—	—13.5	5	—	9	1000	—	—	
18	—	Power Amplifier Pentode	5H	14.0	0.300	C	250	250	—16.5	34	7.5	185	2350	3400	7000	NU
19	1J6G	Class B Twin Amplifier	6C	2.0	0.260	F(O)	135	—	0	10	—	—	—	2100(2)	10000(2)	NU
20	—	Power Amplifier Triode	4D	5.3	0.132	F(O)	135	—	—22.5	6.5	—	3.5	525	110	6500	NU
KR20	—	Special Detector	6N	2.5	1.000	C	250	—	0	3.5	—	14	1400	—	—	
21A7		Triode Hexode Converter	8AR	21.0	0.150	C	250	100	— 3.0	1.3	2.8	—	275	—	—	
						Tri.	150	—	— 3.0	3.5	—	32	1900	—	—	
22	—	Screen Grid R.F. Amplifier	4K	3.3	0.132	F(O)	135	67.5	— 1.5	3.7	1.3	160	500	—	—	NU
A22	—	Screen Grid R.F. Amplifier	4Q	15.0	0.350	C	135	45	— 1.5	2.0	0.4	300	600	—	—	
AC22	24A	Screen Grid R.F. Amplifier	5E	2.5	1.750	C	250	90	— 3.0	4	1.7	630	1050	—	—	Replace with NU24A
KR22	—	Special Detector	6N	6.3	0.400	C	250	—	0	3.5	—	14	1400	—	100,000	
K24	24A	Screen Grid R.F. Amplifier	5E	2.5	1.750	C	180	75	— 1.5	2	—	—	800	—	—	Replace with NU24A
24A	—	Screen Grid R.F. Amplifier	5E	2.5	1.750	C	250	90	— 3.0	4	1.7	630	1050	—	—	NU
24S	24A	Screen Grid R.F. Amplifier	5E	2.5	1.750	C	250	90	— 3.0	4	1.7	630	1050	—	—	NU
25-25S	1B5	Duplex Diode Triode	6M	2.0	0.060	F	135	—	— 3.0	1	—	20	475	—	—	Replace with NU1B5/25S
KR25	2A5	Power Amplifier Pentode	6B	2.5	1.750	C	250	250	—16.5	34	6.5	220	2200	3000	7000	Replace with NU2A5
25A6	43	Power Amplifier Pentode ⊖	7S	25.0	0.300	C	180	135	—20	38	7.5	100	2500	2750	5000	Replace w. NU25A6GT/G
25A6G	43	Power Amplifier Pentode ⊖	7S	25.0	0.300	C	180	135	—20	38.0	7.5	100	2500	2750	5000	Replace w. NU25A6GT/G
25A6GT	25A6G	Power Amplifier Pentode	7S	25.0	0.300	C	180	135	—20	38	7.5	100	2500	2750	5000	Replace w. NU25A6GT/G
25A6GT/G	25A6G	Power Amplifier Pentode⊖	7S	25.0	0.300	C	180	135	—20	38	7.5	100	2500	2750	5000	NU
25A6MG	43	Power Amplifier Pentode ⊖	7S	25.0	0.300	C	180	135	—20	38	7.5	100	2500	2750	5000	Replace w. NU25A6GT/G
25A7G	—	Pentode and Half Wave Rectifier*	8F	25.0	0.300	C	100	100	—15	20.5	4.0	90	1800	770	4500	
							125	—	—	75	—	—	—	—	—	Replace with NU25A7GT/G
25A7GT/G	25A7G	Pentode and Half Wave Rectifier	8F	25.0	0.300	C Pen.	100	100	—15	20.5	4.0	90	1800	770	4500	
						Rec.	125			75	—					NU
25AC5G	6AC5G	Power Amplifier-Positive Grid	6Q	25.0	0.300	C	110	—	+15	45	—	58	3800	2000	2000	Replace with NU25AC5GT/
25AC5GT/G	25AC5G	Power Amplifier-Positive Grid	6Q	25.0	0.300	C	110	—	+15.0	45.0	—	58	3800	2000	2000	NU
25B5	—	Power Amplifier Direct Coupled	6D	25.0	0.300	C	110	Input		7.0	—					
							110	Output	0	45	—	25	2200	2000	2000	
25B6G	43	Power Amplifier-Pentode ⊖	7S	25.0	0.300	C	95	95	—15	45	4.0	—	4000	1750	2000	NU
25B8GT	12B8GT	Triode-Pentode	8T	25.0	0.150	C	T100	—	— 1	0.6		112.5	1500	—	—	
							P100	100	— 3	7.8	2.0	370	2000	—	—	NU
25C6G		Beam Power Amplifier	7AC	25.0	0.300	C	200	135	—14.0	68	9.0	—	7100	6000	2600	NU
25D8GT	—	Diode-Triode-Pentode	8AF	25.0	0.150	C	T100	—	— 1	0.5	—	100	1100	—	—	
							P100	100	— 3	8.5	2.7	—	1900	—	—	
25L6	—	Beam Power Amplifier	7AC	25.0	0.300	C	110	110	— 8	45	3.5	80	8000	2200	2000	Replace w. NU25L6GT/G
25L6G	—	Beam Power Amplifier ⊖	7AC	25.0	0.300	C	110	110	— 8.0	45	3.5	80	8000	2200	2000	Replace w. NU25L6GT/G
25L6GT	—	Beam Power Amplifier	7AC	25.0	0.300	C	110	110	— 7.5	49	4.0	82	8200	2200	2000	Replace w. NU25L6GT/G
25L6GT/G	—	Beam Power Amplifier	7AC	25.0	0.300	C	110	110	— 7.5	49	4.0	82	8200	2200	2000	NU
25N6G	—	Power Amplifier Direct Coupled ⊖	7W	25.0	0.300	C	110	Input		7.0	—					
							110	Output	0	45	—	25	2200	2000	2000	NU
25X6GT	25Z6GT	Voltage Doubling Rectifier	7Q	25.0	0.150	C	125	—	—	6.0	—	—	—	—	—	NU
25Y4GT		Half Wave Rectifier	5AA	25.0	0.150	C	125	—	—	75	—	—	—	—	—	
25Y5	25Z5	Voltage Doubling Rectifier	6E	25.0	0.300	C	250	—	—	85	—	—	—	—	—	NU
25Z3	—	Half Wave Rectifier	4G	25.0	0.300	C	250	—	—	50	—	—	—	—	—	
25Z4	—	Half Wave Rectifier	5AA	25.0	0.300	C	125	—	—	125	—	—	—	—	—	
25Z4GT		Half Wave Rectifier	5AA	25.0	0.300	C	125	—	—	125	—	—	—	—	—	
25Z5	25Y5	Voltage Doubling Rectifier	6E	25.0	0.300	C	125	—	—	100	—	—	—	—	—	NU
25Z5MG	25Z5	Voltage Doubling Rectifier	6E	25.0	0.300	C	125	—	—	100	—	—	—	—	—	Replace w. NU25Z5
25Z6	25Z5	Voltage Doubling Rectifier ⊖	7Q	25.0	0.300	C	125	—	—	85	—	—	—	—	—	Replace w. NU25Z6GT/G
25Z6G	25Z5	Voltage Doubling Rectifier ⊖	7Q	25.0	0.300	C	125	—	—	85	—	—	—	—	—	Replace with NU25Z6GT/G
25Z6GT	25Z6G	Voltage Doubling Rectifier	7Q	25.0	0.300	C	125	—	—	85	—	—	—	—	—	Replace w. NU25Z6GT/G
25Z6GT/G	—	Voltage Doubling Rectifier	7Q	25.0	0.300	C	125	—	—	85	—	—	—	—	—	NU
25Z6MG	25Z6	Voltage Doubling Rectifier ⊖	7Q	25.0	0.300	C	125	—	—	85	—	—	—	—	—	Replace w. NU25Z6GT/G
26	—	Triode Amplifier	4D	1.5	1.050	F(O)	180	—	—14.5	6.2	—	8.3	1150	—	—	NU
27	56	Triode Detector-Amplifier	5A	2.5	1.750	C	250	—	—21.0	5.2	—	9.0	975	—	—	NU
K27	27-56	Triode Detector-Amplifier	5A	2.5	1.750	C	90	—	— 4.5	3.0	—	9.0	1000	—	—	Replace with NU27
27HM	27-56	Triode Detector-Amplifier	5A	2.5	1.750	C	180	—	—13.5	5.0	—	13.0	1350	—	—	Replace with NU27
27S	27-56	Triode Detector-Amplifier	5A	2.5	1.750	C	250	—	—21.0	5.2	—	9.0	975	—	—	NU
A28	—	Triode Detector-Amplifier	4Q	15.0	0.350	C	90	—	— 1.5	7.5	—	10.5	1165	—	—	
KR28	84	Full Wave Rectifier *	5D	6.3	0.500	C	350	—	—	50	—	—	—	—	—	Replace with NU84-6Z4
29	—	Special Detector	6N	2.5	1.000	C	180	—	— 3.0	4.6	—	30	1450	—	—	
30	1H4G	Triode Detector-Amplifier	4D	2.0	0.060	F(O)	180	—	—13.5	3.1	—	9.3	900	—	—	NU
A30	—	Power Amplifier Triode	4Q	15.0	0.350	C	180	—	—27.0	22.0	—	3.0	1085	—	—	
31	—	Power Amplifier Triode	4D	2.0	0.130	F(O)	180	—	—16.0	12.5	—	3.8	1050	375	5700	NU
KR31	—	Half Wave Rectifier *	4G	10.0	0.500	C	350	—	—	100	—	—	—	—	—	
32	1B4	Screen Grid R.F. Amplifier	4K	2.0	0.060	F(O)	180	67.5	— 3.0	1.7	0.4	780	650	—	—	NU
32L7GT	—	Beam Power Amplifier					90	90	— 7.0	27	2.0	81	4800	1000	2600	
		Rectifier	8F	32.5	0.300	C	125	—	—	60	—	—	—	—	—	NU
A32	—	Triode Amplifier	4Q	15.0	0.350	C	135	—	— 3.0	1.5	—	30	940	—	—	
33	—	Power Amplifier Pentode	5K	2.0	0.260	F(O)	180	180	—18.0	22	5	90	1700	1400	6000	NU
34	1A4	Super Control R.F. Amplifier	4M	2.0	0.060	F(O)	180	67.5	— 3.0	2.6	1.0	620	620	—	—	NU
35-51	—	Super Control R.F. Amplifier	5E	2.5	1.750	C	250	90	— 3.0	6.8	2.5	420	1050	—	—	NU
35A5	—	Power Amplifier Pentode	6AA	35.0	0.160	C	110	110	— 7.5	35	2.8	—	5500	1400	2500	NU
35A5LT	35A5	Beam Power Amplifier	6AA	35.0	0.150	C	110	110	— 7.5	40.0	3.0	—	5800	1500	2500	Replace w. NU35A5
35L6G	—	Beam Power Amplifier	7AC	35.0	0.150	C	110	110	— 7.5	40	3.0	80	5800	1500	2500	Replace w. NU35L6GT/G
35L6GT	—	Beam Power Amplifier	7AC	35.0	0.150	C	110	110	— 7.5	40	3	80	5800	1500	2500	Replace w. NU35L6GT/G
35L6GT/G	—	Beam Power Amplifier	7AC	35.0	0.150	C	110	110	— 7.5	40	3	80	5800	1500	2500	NU

Note: *(If a tube whose data is desired is not listed in this tube chart, see "Supplementary Tube Chart" on Pages 607 to 608.)*

(Cont'd)

Receiving Tube Operating Characteristics and Basing Diagram Charts

Type Number	Similar To	Description	Base Connection	Filament Volts	Filament Amps.	Filament Type	Plate Volts	Screen Volts	Control Grid Volts	Plate Current (MA)	Screen Current (MA)	Amplification Factor	Mutual Conductance in Micromhos	Power Output in Milliwatts	Load Resistance in Ohms	
35S-51S	35	Super Control R.F. Amplifier	5E	2.5	1.750	C	250	90	— 3.0	6.5	2.5	420	1050	—	—	NU
35Y4	35Z5GT	Half Wave Rectifier	5AL	35.0	0.150	C	235	—	—	100	—	—	—	—	—	
35Z3	—	Half Wave Rectifier	4Z	35.0	0.160	C	250	—	—	100	—	—	—	—	—	NU
35Z3LT	35Z3	Half Wave Rectifier	4Z	35.0	0.150	C	250	—	—	100	—	—	—	—	—	Replace w. NU35Z3
35Z4GT	—	Half Wave Rectifier	5AA	35.0	0.150	C	250	—	—	100	—	—	—	—	—	NU
35Z5G		Half Wave Rectifier	6AD	35.0	0.150	C	125	—	—	100	—	—	—	—	—	Replace w. NU35Z5GT/G
35Z5GT	—	Half Wave Rectifier	6AD	35.0	0.150	C	125	—	—	100	—	—	—	—	—	Replace w. NU35Z5GT/G
35Z5GT/G	—	Half Wave Rectifier	6AD	35.0	0.150	C	125	—	—	100	—	—	—	—	—	NU
35Z6G	—	Full Wave Rectifier	7Q	35.0	0.360	C	117	—	—	110.0	—	—	—	—	—	NU
36	—	Screen Grid R.F. Amplifier	5E	6.3	0.300	C	250	90	— 3.0	3.2	1.7	595	1080	—	—	NU
37	—	Triode Dector-Amplifier	5A	6.3	0.300	C	250	—	—18.0	7.5	—	9.2	1100	—	—	NU
38	—	Power Amplifier Pentode	5F	6.3	0.300	C	250	250	—25.0	22	3.8	120	1200	2500	10000	NU
39/44																
39A/44A	—	Super Control R.F. Amplifier	5F	6.3	0.300	C	250	90	— 3.0	5.8	1.4	1050	1050	—	—	NU
40	—	Triode Voltage Amplifier	4D	5.0	0.250	F(T)	180	—	— 3.0	0.2	—	30	200	—	—	Obsolete
A40	—	Power Amplifier Triode	4Q	13.0	0.400	C	180	—	—40.5	21	—	3	1500	—	—	
40Z5/45Z5GT	45Z5GT	Half Wave Rectifier	6AD	45.0	0.150	C	125	—	—	100.0	—	—	—	—	—	Rep. w. NU45Z5GT/40Z5GT
41	42	Power Amplifier Pentode	6B	6.3	0.400	C	250	250	—18.0	32	5.5	150	2200	3400	7600	NU
42	—	Power Amplifier Pentode	6B	6.3	0.700	C	250	250	—16.5	34	6.5	220	2200	3000	7000	NU
42A1	—	Ballast Tube		42.3	—	—	—	—		—	—	—	—	—	—	
42A2	—	Ballast Tube		42.3		—	with	Tap	For	One	Pilot	Lamp	—	—	—	
42B2	—	Ballast Tube		42.3		—	with	Tap	For	Two	Pilot	Lamps	—	—	—	
43	—	Power Amplifier Pentode	6B	25.0	0.300	C	180	135	—20.0	40	8	96	2400	2750	5000	NU
43MG	43	Power Amplifier Pentode o		25.0	0.300	C	180	135	—20.0	40	8	96	2400	2750	5000	Replace with NU43
44	39/44	Super Control R.F. Amplifier	5F	6.3	0.300	C	250	90	— 3.0	5.8	1.4	1050	1050	—	—	Replace with NU39/44
45	—	Power Amplifier Triode	4D	2.5	1.500	F(O)	250	—	—50	34	—	3.5	2175	1600	3900	NU
45A	45	Power Amplifier Triode	4D	2.5	1.500	F(O)	325	—	—68	43	—	3.5	2370	3000	3200	Replace with NU45
45Z3	—	Half Wave Rectifier	5AM	45.0	0.050	F(O)	117	—	—	65	—	—	—	—	—	NU
45Z5GT/40Z5GT	—	Half Wave Rectifier	6AD	45.0	0.150	C	125	—	—	100	—	—	—	—	—	NU
							(A)250	—	—65	22	—	5.6	2350	1250	6400	
46	—	Power Amplifier Dual Grid	5C	2.5	1.750	F(O)	(B)400	—	0	0	—	—	—	20000(2)	5800(2)	NU
46A1	—	Ballast Lamp		46.1	0.400	F	—	—	—	—	—	—	—	—	—	
46B1	—	Ballast Lamp		46.1	0.300	F	—	—	—	—	—	—	—	—	—	
47	—	Power Amplifier Pentode	5B	2.5	1.750	F(O)	250	250	—16.5	31	6	150	2500	2700	7000	NU
							125	100	—20.0	56	9.5	—	3800	2500	1500	
48	—	Power Amplifier Tetrode	8A	30.0	0.400	C	90	90	—18.0	52	9.0	—	3800	2000	1800	NU
A48	—	Triode Detector-Amplifier	4Q	10.0	0.350	C	90	—	— 4.5	4.6	—	11	1185	—	—	
							(A)135	—	—20.0	8	—	4.7	1125	170	11000	
49	—	Power Amplifier Dual Grid	5C	2.0	0.120	F(O)	(B)180	—	0	2	—	—	—	3500(2)	12000(2)	NU
49A1	—	Ballast Lamp		48.6	—	—	—	—	—	—	—	—	—	—	—	
49A2	—	Ballast Lamp		48.6	—	—	with	Tap	For	One	Pilot	Light	—	—	—	
49B2	—	Ballast Lamp		48.6	—	—	with	Tap	For	Two	Pilot	Lights	—	—	—	
50	—	Power Amplifier Triode	4D	7.5	1.250	F(O)	450	—	—84	55	—	3.8	2100	4600	4350	NU
50A5	50L6GT	Beam Power Amplifier	6AA	50.0	0.150	C	200	110	— 8.0	55	6.0	—	8250	4700	3000	
50C6G	—	Beam Power Amplifier	7AC	50.0	0.150	C	200	135	—14.0	66.0	9.0	—	7100	6000	2600	
50L6GT	6L6G	Beam Power Amplifier	7AC	50.0	0.150	C	110	110	— 7.5	43	4	68	6800	1750	2000	NU
50Y6G	—	Voltage Doubling Rectifier	7Q	50.0	0.150	C	125	—	—	85	—	—	—	—	—	Replace w. NU50Y6GT/G
50Y6GT		Full Wave Rectifier	7Q	50.0	0.150	C	125	—	—	85	—	—	—	—	—	Replace w. NU50Y6GT/G
50Y6GT/G	—	Full Wave Rectifier	7Q	50.0	0.150	C	125	—	—	85	—	—	—	—	—	NU
50Z6G	—	Voltage Doubling Rectifier	7Q	50.0	0.300	C	125	—	—	180	—	—	—	—	—	
50Z7G		Voltage Doubling Rectifier	8AN	50.0	0.150	C	117	—	—	65	—	—	—	—	—	NU
HZ30	12Z3	Half Wave Rectifier	4G	12.6	0.300	C	250	—	—	60	—	—	—	—	—	Replace with NU12Z3
51	35	Super Control R.F. Amplifier	5E	2.5	1.750	C	250	90	— 3.0	6.5	2.5	420	1050	—	—	Replace with NU35/51
51S	35	Super Control R.F. Amplifier	5E	2.5	1.750	C	250	90	— 3.0	6.5	2.5	420	1050	—	—	Replace with NU35S/51S
							110(A)	110	0	43	—	5.2	3000	1500	2000	
52	—	Power Amplifier Dual Grid	5C	6.3	0.300	F	180(B)	—	0	6	—	—	—	6000	9000	
53	—	Class B Twin Amplifier	7B	2.5	2.000	C	300	—	0	17.5	—	—	—	10000(2)	10000(2)	NU
55	—	Duplex Diode Triode	6G	2.5	1.000	C	250	—	—20	8	—	8.3	1100	350	20000	NU
55S	55	Duplex Diode Triode	6G	2.5	1.000	C	250	—	—20	8	—	8.3	1100	350	20000	NU
55A1	—	Ballast Lamp		54.9	—	—	—	—	—	—	—	—	—	—	—	
55A2	—	Ballast Lamp		54.9	—	—	with	Tap	For	One	Pilot	Light	—	—	—	
55B2	—	Ballast Lamp		54.9	—	—	with	Tap	For	Two	Pilot	Lights	—	—	—	
56	27	Triode Detector-Amplifier	5A	2.5	1.000	C	250	—	—13.5	5	—	13.8	1450	—	—	NU
56A	76	Triode Detector-Amplifier	5A	6.3	0.400	C	250	—	—13.5	5	—	13.8	1450	—	—	Replace with NU76
56AS	76	Triode Detector-Amplifier	5A	6.3	0.400	C	250	—	—13.5	5	—	13.8	1450	—	—	Replace with NU76
56S	56	Triode Detector-Amplifier	5A	2.5	1.000	C	250	—	—13.5	5	—	13.8	1450	—	—	NU
57	—	Triple Grid Detector Amplifier	6F	2.5	1.000	C	250	100	— 3.0	2	0.5	1500	1225	—	—	NU
57A	77-6C6	Triple Grid Detector Amplifier	6F	6.3	0.400	C	250	100	— 3.0	2	0.5	1500	1225	—	—	Replace with NU77
57AS	77-6C6	Triple Grid Detector Amplifier	6F	6.3	0.400	C	250	100	— 3.0	2	0.5	1500	1225	—	—	NU
57S	57	Triple Grid Detector Amplifier	6F	2.5	1.000	C	250	100	— 3.0	2	0.5	1500	1225	—	—	NU
58	—	Super Control R.F. Amplifier	6F	2.5	1.000	C	250	100	— 3.0	8.2	2.0	1280	1600	—	—	NU
58A	78-6D6	Super Control R.F. Amplifier	6F	6.3	0.400	C	250	100	— 3.0	8.2	2.0	1280	1600	—	—	Replace with NU78
58AS	78-6D6	Super Control R.F. Amplifier	6F	6.3	0.400	C	250	100	— 3.0	8.2	2.0	1280	1600	—	—	NU
58S	58	Super Control R.F. Amplifier	6F	2.5	1.000	C	250	100	— 3.0	8.2	2.0	1280	1600	—	—	NU
59	—	Power Amplifier Pentode	7A	2.5	2.000	C	250	250	—18.0	35	9	100	2500	3000	6000	NU
59B	59	Power Amplifier Pentode	7M	2.5	2.000	F(O)	250	250	—28.0	26	—	6	2600	1250	5000	
64-64A	36	Screen Grid R.F. Amplifier	5E	6.3	0.400	C	180	90	— 3.0	3.1	1.5	525	1050	—	—	Obsolete
65-65A	39/44	Super Control R.F. Amplifier	5E	6.3	0.400	C	180	90	— 3.0	4.5	1.3	750	1000	—	—	Obsolete

Note: (*If a tube whose data is desired is not listed in this tube chart, see "Supplementary Tube Chart" on Pages 606 to 608.*)

(Cont'd over)

(Cont'd)

Type Number	Similar To	Description	Base Connection	Filament Volts	Filament Amps.	Filament Type	Plate Volts	Screen Volts	Control Grid Volts	Plate Current (MA)	Screen Current (MA)	Amplification Factor	Mutual Conductance in Micromhos	Power Output in Milliwatts	Load Resistance in Ohms	
67-67A	37	Triode Detector-Amplifier	5A	6.3	0.400	C	180	4.3	— —		—13.5	9.2	900	—	—	Obsolete
68-68A	38	Power Amplifier Pentode	5E	6.3	0.400	C	135	90	—13.5	14	3	90	1400	650	7500	Obsolete
69		Detector-Double Grid	6N	6.3	0.300	C	180	—	— 3.0	4.5	—	30	1450	—	—	
70		Detector-Double Grid	6N	6.3	0.300	C	180	—	— 6.0	2.3	—	15	500	—	—	
70A7GT		Rectifier Beam Power Amplifier	8AB	70.0	0.150	C	110	110	— 7.5	40	3.0	80	5800	1500	2500	NU
						Rec.	125	—	—	60	—	—	—	—	—	
76L7GT	—	Rectifier-Beam Power Amplifier	8AA	70.0	0.150	C	R125 A110	— 110	— — 7.5	70 40	— 3	— —	— 7500	— 1800	— 2000	NU
71	71A	Power Amplifier Triode	4D	5.0	0.500	F(T)	180	—	—40.5	20	—	3	1700	790	4800	Replace with NU71A
71A		Power Amplifier Triode	4D	5.0	0.250	F(O)	180	—	—40.5	20	—	3	1700	790	4800	NU
71B	71A	Power Amplifier Triode	4D	5.0	—	—	180	—	—40.5	20	—	3	1700	790	4800	Replace with NU71A
75	—	Duplex Diode Triode	6G	6.3	0.300	C	250	—	— 2.0	0.8	—	100	1100	—	—	NU
75S	75	Duplex Diode Triode	6G	6.3	0.300	C	250	—	— 2.0	0.8	—	100	1100	—	—	Replace with NU75
76	37	Triode Detector-Amplifier	5A	6.3	0.300	C	250	—	—13.5	8	—	13.8	1450	—	—	NU
77	6C6	Triple Grid Detector-Amplifier	6F	6.3	0.300	C	250	100	— 3.0	2.3	0.5	1500	1250	—	—	NU
78	6D6	Super Control R.F. Amplifier	6F	6.3	0.300	C	250	100	— 3.0	7.0	1.7	1160	1450	—	—	NU
79	—	Class B Twin Amplifier	6H	6.3	0.600	C	250	—	6	10.5	—	—	—	8000(2)	14000(2)	NU
80	—	Full Wave Rectifier	4C	5.0	2.000	F(O)	400	—	—	110	—	—	—	—	—	NU
80M	80	Full Wave Rectifier *	4C	5.0	2.000	F(O)	450	—	—	125	—	—	—	—	—	Replace with NU80
80A1	—	Ballast Lamp		79.7	—	—	—	—	—	—	—	—	—	—	—	
80A2	—	Ballast Lamp		79.7	—	—	with	Tap	For	One	Pilot	Light	—	—	—	
80B2	—	Ballast Lamp		79.7	—	—	with	Tap	For	Two	Pilot	Lights	—	—	—	
81	—	Half Wave Rectifier	4B	7.5	1.250	F(O)	700	—	—	85	—	—	—	—	—	NU
81M	81	Half Wave Rectifier	4B	7.5	1.250	F(O)	750	—	—	85	—	—	—	—	—	Replace with NU81
82	—	Full Wave Rectifier *	4C	2.5	3.000	F(O)	500	—	—	125	—	—	—	—	—	NU
83	5Z3	Full Wave Rectifier *	4C	5.0	3.000	F(O)	500	—	—	250	—	—	—	—	—	NU
83V	83-5Z3	Full Wave Rectifier	4AD	5.0	2.000	C	400	—	—	200	—	—	—	—	—	NU
84-6Z4	6Z4	Full Wave Rectifier	5D	6.3	0.500	C	350	—	—	75	—	—	—	—	—	NU
G-84	2Z2	Half Wave Rectifier	4B	2.5	1.500	F	350	—	—	50	—	—	—	—	—	
85	—	Duplex Diode Triode	6G	6.3	0.300	C	250	—	—20.0	8	—	8.3	1150	350	20000	NU
85AS	—	Duplex Diode Triode	6G	6.3	0.300	C	250	—	— 9.0	4.5	—	20	1250	—	—	NU
85S	85	Duplex Diode Triode	6G	6.3	0.300	C	250	—	—28.0	8	—	8.3	1100	350	20000	Replace with NU85
86A1	—	Ballast Lamp		86.0	—	—	—	—	—	—	—	—	—	—	—	
86A2	—	Ballast Lamp		86.0	—	—	with	Tap	For	One	Pilot	Light	—	—	—	
86B2	—	Ballast Lamp		86.0	—	—	with	Tap	For	Two	Pilot	Lights	—	—	—	
88	83V	Full Wave Rectifier	4C	5.0	2.000	F(O)	450	—	—	125	—	—	—	—	—	Replace with NU83V
89	—	Power Amplifier Pentode	6F	6.3	0.400	C	250	250	—25.0	52	5.5	125	1900	3400	6750	NU
92	—	Detector-Double Grid	6N	2.5	1.000	C	—	—	0	3.5	—	14	1400	—	100,000	
90	—	Detector-Double Grid	6N	6.3	0.400	C	—	—	0	3.5	—	14	1400	—	100,000	
92A1	—	Ballast Lamp		92.3	—	—	—	—	—	—	—	—	—	—	—	
92A2	—	Ballast Lamp		92.3	—	—	with	Tap	For	One	Pilot	Light	—	—	—	
92B2	—	Ballast Lamp		92.3	—	—	with	Tap	For	Two	Pilot	Lights	—	—	—	
95	2A5	Power Amplifier Pentode	6B	2.5	1.750	C	315	315	—22.0	42	8	220	2300	5000	7000	Replace with NU2A5
96	—	Half Wave Rectifier *	4B	10.0	0.500	C	350	—	—	100	—	—	—	—	—	
KR98	84	Full Wave Rectifier *	5D	6.3	0.500	C	350	—	—	50	—	—	—	—	—	Replace with NU84
V99	X99	Triode Detector-Amplifier	4E	3.3	0.063	F(T)	90	—	— 4.5	2.5	—	6.6	425	—	—	NU
X99	—	Triode Detector-Amplifier	4D	3.3	0.063	F(O)	90	—	— 4.5	2.5	—	6.6	425	—	—	NU
117L7GT	—	Rectifier-Beam Power Amplifier	8AO	117.0	0.090	C	R105 A105	— 105	— — 5.5	75.0 45.0	— 4.0	— —	— 4000	— 550	— 4000	Replace w. NU117L7GT/117M7GT
117L7GT/117M7GT	—	Rectifier-Beam Power Amplifier	8AO	117.0	0.090	(R) C(P)	117 105	— 105	— — 5.2	75 43	— 4.0	— —	— 5300	— 850	— 4000	NU
117M7GT	—	Rectifier-Power Amplifier	8AO	117.0	0.090	(R) C(P)	117 100	— 100	— — 5.5	75.0 50.0	— 4.5	— —	— 7000	— 1200	— 2000	Replace w. NU117L7GT/117M7GT
117N7GT	—	Rectifier-Beam Power Amplifier	8AV	117.0	0.090	C	R117 A100	— 100	— — 6.0	75 51	— 5.0	— —	— 7000	— 1200	— 3000	NU
117P7GT	—	Rectifier-Beam Power Amplifier	8AV	117.0	0.090	(R) C(P)	117 105	— 105	— — 5.2	75 43	— 4.0	— —	— 5300	— 850	— 4000	NU
117Z4GT	—	Half Wave Rectifier	5AA	117.0	0.040	C	117	—	—	90	—	—	—	—	—	NU
117Z6G		Full Wave Rectifier	7Q	117.0	0.075	C	117	—	—	60	—	—	—	—	—	
				58.5	0.150		117	—	—	60	—	—	—	—	—	Replace w. NU117Z6GT/G
117Z6GT		Full Wave Rectifier	7Q	117.0	0.075	C	117	—	—	60	—	—	—	—	—	
				58.5	0.150		117	—	—	60	—	—	—	—	—	Replace w. NU117Z6GT/G
117Z6GT/G	—	Full Wave Rectifier		117.0	0.075	C	117	—	—	60	—	—	—	—	—	NU
			7Q	58.5	0.150		117	—	—	60	—	—	—	—	—	
140R	—	Ballast Lamp		42.3	—	—	—	—	—	—	—	—	—	—	—	
140R4	—	Ballast Lamp		42.3	With	Tap	For One	Pilot	Light	—	—	—	—	—	—	
140R8	—	Ballast Lamp		42.3	With	Tap	For Two	Pilot	Lights	—	—	—	—	—	—	
165R	—	Ballast Lamp		48.6	—	—	—	—	—	—	—	—	—	—	—	
165R4	—	Ballast Lamp		48.6	With	Tap	For One	Pilot	Light	—	—	—	—	—	—	
165R8	—	Ballast Lamp		48.6	With	Tap	For Two	Pilot	Lights	—	—	—	—	—	—	
181	—	Power Amplifier Triode	4D	3.0	1.350	C	180	—	—35.0	16	—	8	1050	—	—	
182A	71A	Power Amplifier Triode	4D	5.0	0.800	F(O)	200	—	—45.0	18	—	3	1500	1500	4500	Replace with NU71A
182B	483	Power Amplifier Triode	4D	5.0	1.250	F(O)	250	—	—35.0	18	—	5	1500	1750	—	Replace with NU483
183	483	Power Amplifier Triode	4D	5.0	1.250	F(O)	250	—	—90.0	25	—	3.2	1800	2000	—	Replace with NU483
185R	—	Ballast Lamp		54.9	—	—	—	—	—	—	—	—	—	—	—	
185R4	—	Ballast Lamp		54.9	—	With	Tap	For One	Pilot		Light	—	—	—	—	

Note: *(If a tube whose data is desired is not listed in this tube chart, see "Supplementary Tube Chart" on Pages 606 to 608.)*

(Cont'd)

(Cont'd)

Type Number	Similar To	Description	Base Connection	Filament Volts	Filament Amps.	Filament Type	Plate Volts	Screen Volts	Control Grid Volts	Plate Current (MA)	Screen Current (MA)	Amplification Factor	Mutual Conductance in Micromhos	Power Output in Milliwatts	Load Resistance in Ohms	
185R8	—	Ballast Lamp •		54.9	—	With	Tap	For Two	Pilot	Lights	—	—	—	—	—	
213	80	Full Wave Rectifier	4C	5.0	2.000	F(T)	220	—	—	85	—	—	—	—	—	Replace with NU80
216	81	Half Wave Rectifier	4B	7.5	1.250	F(T)	550	—	—	65	—	—	—	—	—	Replace with NU81
257	—	Power Amplifier Pentode	5B	5.0	0.300	F	110	110	—21.5	20	7	55	1350	800	—	
264	WX12	Triode-Non Microphonic	4D	1.1	0.250	F(O)	135	—	— 9.0	3.5	—	8.2	645	—	—	
291	—	Triple Twin Amplifier	5G	12.3	0.300	C F(O)	175.5 180	Input Output	—11.0 +11.0	8 30	— —	— —	— —	— 1250	— 3000	
293	—	Triple Twin Amplifier	5G	6.3	0.600	C F(O)	250 250	Input Output	— 8.5 + 8.5	4 17.5	— —	— —	— —	— 1250	— 8000	
295	—	Triple Twin Amplifier	5G	2.5	4.000	C F(O)	250 250	Input Output	—14.0 — 8.0	4 52	— —	— —	— —	— 4500	— 4000	
401	—	Triode Detector-Amplifier	4D	3.0	1.350	C	90	—	— 3.0	8	—	9.5	1000	—	—	
401A	—	Triode Detector-Amplifier	4D	5.0	0.250	F	45	—	— 9.0	1.8	—	8.0	800	55	20000	Replace with NU01A
402-403	—	Power Amplifier Triode	4D	3.0	1.500	F(O)	180	—	—40.0	20	—	3	1000	—	—	
450	50	Power Amplifier Triode	4D	7.5	1.250	F(O)	450	—	—84.0	55	—	3.8	2100	4600	4350	Replace with NU50
482A	71A	Power Amplifier Triode	4D	5.0	0.800	F(O)	200	—	—45.0	18	—	3	1500	1500	4500	Replace with NU71A
482B	—	Power Amplifier Triode	4D	5.0	1.250	F(O)	250	—	—35.0	18	—	5	1500	1750	4500	Replace with NU483
483	182B	Power Amplifier Triode	4D	5.0	1.250	F(O)	250	—	—65.0	20	—	3	1500	2000	4500	NU
484	485	Triode Detector-Amplifier	5A	2.8	1.600	C	180	—	— 9.0	6	—	12.5	1350	—	—	Replace with NU485
485	484	Triode Detector Amplifier	5A	3.0	1.250	C	180	—	— 9.0	—	9	12.5	1350	—	—	NU
486	—	Triode Amplifier	5S	3.0	0.250	F	90	—	— 3.0	3	—	12.5	450	—	—	
585	50	Power Amplifier Triode	4D	7.5	1.250	F(O)	450	—	—84.0	55	—	3.8	2100	4600	4350	Replace with NU50
586	50	Power Amplifier Triode	4D	7.5	1.250	F(O)	450	—	—84.0	55	—	3.8	2100	4600	4350	Replace with NU50
840	—	R.F. Pentode	5J	2.0	0.130	F(O)	180	67.5	— 3.0	1.0	0.7	400	400	—	—	
P861	84	Full Wave Rectifier	5D	6.3	0.500	C	225	—	—	50	—	—	—	—	—	Replace with NU84
864	WX12	Triode Non-Microphonic	4D	1.1	0.250	F(O)	135	—	— 9.0	3.5	—	8.2	645	—	—	
866	—	Half Wave Rectifier	4P	2.5	5.0	F(O)	7500	—	—	600	—	—	—	—	—	
874	—	Voltage Regulator •	4S	—	—	—	90	—	—	10-50	—	—	—	—	—	
876	—	Ballast Tube	—	40-50	1.700	†	—	—	—	—	—	—	—	—	—	
886	—	Ballast Tube	—	40-60	2.050	F	—	—	—	—	—	—	—	—	—	
950	1F4	Power Amplifier Pentode	5K	2.0	0.125	F(O)	135	135	—16.5	5.5	2	100	650	—	—	NU
951	1B4	Screen Grid R F Amplifier	5K	2.0	0.060	F(O)	180	67.5	— 3.0	1.7	0.6	780	650	—	—	Replace with NU-1B4
985	—	Full Wave Rectifier *	5D	5.0	0.500	F(O)	250	—	—	50	—	—	—	—	—	
986	83	Full Wave Rectifier *	4C	5.0	1.000	F(O)	400	—	—	150	—	—	—	—	—	Replace with NU-83
†1201	—	Ultra High Frequency Triode	8XA	6.3	0.150	C	180	—	— 3.0	5.5	—	36	3000	—	—	
†1203A	—	High Frequency Diode	8XB	6.3	0.150	C	10	—	—	9.0	—	—	—	—	—	
‡1851		Television Amplifier Pentode	C	6.3	.450	C	300	150	— 2	10	2.5	6750	9000	—	—	
AD	1V	Half Wave Rectifier	4G	6.3	0.300	C	350	—	—	50	—	—	—	—	—	Replace with NU-1V
AF	82	Full Wave Rectifier *	4C	2.5	3.000	F(O)	500	—	—	125	—	—	—	—	—	Replace with NU-82
AG	83	Full Wave Rectifier *	4C	5.0	3.000	F(O)	500	—	—	250	—	—	—	—	—	Replace with NU-83
AX	01A	Triode Detector-Amplifier	4D	5.0	0.250	F(T)	135	—	— 9.0			8	800	55	20000	Replace with NU-01A
B	V99	Triode Detector-Amplifier	4E	3.3	0.063	F(T)	90	—	— 4.5	2.5	—	8.8	425	—	—	Replace with NU-V99
BA	—	Full Wave Gaseous Rectifier	4J	Cold	—	—	350	—	—	350	—	—	—	—	—	
BH	BA	Full Wave Gaseous Rectifier	4J	Cold	—	—	350	—	—	125	—	—	—	—	—	
BR	—	Half Wave Gaseous Rectifier	4H	Cold	—	—	300	—	—	50	—	—	—	—	—	
D½	81	Half Wave Rectifier	4B	7.5	1.250	F(O)	700	—	—	85	—	—	—	—	—	Replace with NU-81
D1	80	Full Wave Rectifier	4C	5.0	2.000	F(O)	350	—	—	125	—	—	—	—	—	Replace with NU-80
DE1	27	Triode Detector	5A	2.5	1.750	C	250	—	—21.0	5.2	—	9	975	300	34000	Replace with NU-27
E	20	Power Amplifier Triode	4D	3.3	0.132	F(O)	135	—	—22.5	6.5	—	3.3	525	110	6500	Replace with NU-20
G	40	Triode Voltage Amplifier	4D	5.0	0.250	F(T)	180	—	— 3.0	0.2	—	30	200	—	—	
GA	—	Pentode	5B	5.0	0.250	F(T)	180	180	—10.0	25	7.5	60	2000	800	7000	
H	01A	Triode Detector	4D	5.0	0.250	F(T)	45	—	0	1.5	—	20	666	—	—	Replace with NU-01A
LA	6A4	Power Amplifier Pentode	5B	6.3	0.300	F(O)	180	180	—12.0	22	3.9	100	2200	1400	8000	Replace with NU-6A4
PZ	47	Power Amplifier Pentode	5B	2.5	1.750	F(O)	250	250	—16.5	31	6	150	2500	2700	7000	Replace with NU-47
PZH	2A5	Power Amplifier Pentode	6B	2.5	1.750	C	250	250	—16.5	34	6.5	220	2200	3900	7000	Replace with NU-2A5
†XXB	—	Double Triode	8X3	1.4 2.8	0.100 0.050	F(O) F(O)	90	—	0	4.5	—	14.5	1300	—	—	
†XXD		Twin Triode Amplifier	8AC	12.6	0.150	C	250	—	—10.0	9.0	—	16	2100	—	—	NU
†XXFM	—	Twin Diode High MU Triode	8XE	6.3	0.300	C	250	—	— 1.0	1.9	—	100	1500	—	—	
†XXL		Triode Amplifier	5AC	6.3	0.300	C	250	—	— 8.0	8.0	—	20	2300	—	—	NU
Wunderlich A Auto	—	Special Detector	6N	6.3	0.400	C	250	—	—16.5	7	—	9.2	900	—	—	
Wunderlich A	—	Special Detector	5H-6N	2.5	1.000	C	250	—	—16.5	7	—	9.2	900	—	—	
Wunderlich B	—	Special Detector	6P	2.5	1.000	C	250	—	—	17	—	—	—	—	—	

★ NOTES

A—Provided filament circuits will accommodate change in filament current.

*—Mercury vapor rectifier.

O—Octal Base.

§Types 1A4G, 1B4G, 1D5GT, and 1E5GT are identical to previous N.U. types 1A4, 1B4, 1D5G, and 1E5G.

59-59B—Tie Suppressor grid terminal of socket to cathode terminal.

Majestic Types. 57AS 58AS 6.3 volt tubes not replaceable by regular types 57 and 58 which are 2.5 volt tubes.

*—Column 2 "Similar To" lists types which are similar to purpose and general characteristics. These types however are not interchangeable except in a very few cases.

Some Serviceman have found that 56S substitutes quite satisfactorily for G4S—since the G4S and G2S are quite similar it may be possible the same substitution can be made with the G2S.

Type 76 may be used to replace 36-67A for greater sensitivity in most cases without circuit changes.

Spartan Type 182B. This type replaceable by NU483 only when all 182B are removed and replaced by NU Type 483

National Union Types 64-67-68-65 are not manufactured by any other company, being replaced by National Union types as follows only when used in Automobile Sets. (64A 36), (67A 37). (68A 38), (65A 39).

Type Filament
F(O)—Oxide Coated Filament
F(T)—Thoriated Tungsten Filament
C—Oxide Coated Cathode

The Filament voltage and current ratings for Loktals, such as 2.0 or 14.0 volts and .320 amps., are nominal values. Typical operating values are 6.3 or 12.6 volts and .300 amps.

‡ Indicates Metal Tubes. G or GT/G types recommended for replacement. In a few instances shielding or realignment may be necessary.
† Indicates Lock-in Tubes

Note: (*If a tube whose data is desired is not listed in this tube chart, see "Supplementary Tube Chart" on Pages 606 to 608.*)

"SUPPLEMENTARY" RECEIVING TUBE CHARACTERISTICS CHART *(see page 594 for explanation)*

Tube Type No.	Basing Code	Fil. Volts	Replaceable By Type No.	Remarks	Mfn'r.
BX	4D	3.3	99	.....	.....
PA	5E	6.3	.....	.....	Arcturus
O1C	4D	5.0	.....	.....	Canadian Whs'e.
1A6S	6L	2.0	1A6*	*Plus external shield	Rogers
1C6S	6L	2.0	1C6*	*Plus external shield	Rogers
1C7M	7Z	2.0	.....	.....	Rogers
1F5	6X	2.0	.....	.....	Rogers
1F7M	7AD	2.0	.....	.....	Rogers
1H4	5S	2.0	1H4G	.....	Rogers
1T5	6AF	1.4	1T5GT	.....	.....
2A6S	6G	2.5	2A6*	*Plus external shield	.....
DV2	4D	5.0	01A	.....	RCA
H2-10	4AB	2.5	2X2/879	.....	Sylvania
2S/4S	5D	2.5	.....	Duodide	Sylvania Raytheon
2X3	4X	2.5	.....	.....	Rogers
2X3G	4X	2.5	.....	.....	.....
2Y3	4X	2.5	.....	.....	Rogers
2Y4	5D	2.5	.....	.....	.....
3AP1	7AN	2.5	.....	Picture tube	.....
3AP4	7AN	2.5	.....	Picture tube	.....
4S	5D	2.5	2S/4S	.....	.....
5BP1	10A	6.3	.....	Picture tube	.....
5BP4	10A	6.3	.....	Picture tube	.....
DV5	4D	5.0	01A	.....	RCA
5Y3	5T	5.0	5Y3G	.....	Sylvania
5Y4	5Q	5.0	5Y4G	.....	Sylvania
6A7M	8A	6.3	6A8*	*Replacement recommended by RCA	Rogers
6AC5	6Q	6.3	6AC5G	.....	Hytron
6AF7	8AG	6.3	.....	.....	.....
6AF7G	....	6.3	.....	.....	.....
6AG6G	7S	6.3	.....	.....	.....
6B6	7V	6.3	6B6G	.....	Sylvania
6B6M	7V	6.3	6B6G*	*Replacement recommended by RCA	Rogers
6B7M	8E	6.3	6B8*	*Replacement recommended by RCA	Rogers
6F5M	5M	6.3	.....	.....	Rogers
6F6M	7S	6.3	6F6*	*Replacement recommended by RCA	Rogers
6F7M	X1	6.3	.....	.....	Rogers
6H7M	X2	6.3	.....	.....	Rogers
6H7S	7P	6.3	.....	.....	Rogers
6H8	8E	6.3	.....	.....	.....
6H8G	....	6.3	.....	.....	.....
6J5M	6Q	6.3	.....	.....	Rogers
6J5MG	6Q	6.3	6J5GT	.....	Hytron
6J7M	7R	6.3	77M	.....	Rogers
6J8M	8A	6.3	.....	.....	Rogers
6K6MG	7S	6.3	6K6GT	.....	RCA
6K7M	7R	6.3	6K7*	*Replacement recommended by RCA	Rogers

"Rogers" is trademark of Canadian Radio Corp. Lt'd.

(Cont'd)

Tube Type No.	Basing Code	Fil. Volts	Replaceable By Type No.	Remarks	Mfn'r.
6M6G	7S	6.3	.....	.....	.....
6M7G	7R	6.3	.....	.....	.....
6M8GT	....	6.3	.....	.....	.....
6N6	7W	6.3	6N6G	.....	RCA
6P7	7U	6.3	6P7G	.....	RCA Sylvania
6P8G	6Q	6.3	.....	.....	.....
6Q6	7V	6.3	6T7G	.....	Sylvania
6R7M	7V	6.3	.....	.....	Rogers
6S5	6R	6.3	.....	.....	.....
6T6	....	6.3	.....	.....	.....
6V7M	7V	6.3	85M	.....	Rogers
6X6	X3	6.3	.....	.....	Rogers
6X6G	7AL	6.3	.....	.....	.....
6Y5S	6J	6.3	6Y5*	*Plus external shield	.....
9AP4	6AL	2.5	.....	Picture tube	.....
9CP4	4AF	2.5	.....	Picture tube	.....
10S	X6	7.5	.....	.....	Triad
12A7GT	7K	12.5	12A7G	.....	Hytron
12AP4	6AL	2.5	.....	Picture tube	.....
12B6	6Y	12.6	.....	.....	.....
12CP4	4AF	2.5	.....	Picture tube	.....
12G7	7V	12.6	.....	.....	.....
12G7G	7V	12.6	12G7	.....	.....
12J5G	6Q	12.6	12J5GT	.....	.....
13	4C	5.0	80	.....	RCA-Sylv
13B	4C	5.0	80	.....	RCA
16	4B	7.5	81	.....	RCA-Sylv
16B	4B	7.5	81	.....	RCA-Sylv
KR18	6B	14.0	2A5 or 42*	*Obsolete change fil. supply	Kenrad
R20	X5	2.8	.....	.....	Rogers
22 (Spec)	4K	14.0	.....	.....	Arcturus
24	5E	2.5	24A	.....	Tung-Sol
24 (Octal)	X11	2.5	.....	.....	Arcturus Coronet
RK24	4D	2.0	.....	.....	Raytheon
25A7	8F	25.0	25A7GT	.....	.....
25C6	7AC	14.0	.....	.....	RCA
27 (Octal)	6Q	2.5	.....	.....	Arcturus Coronet
R30	5A	2.8	.....	.....	Rogers
30S	4D	2.0	30*	*Plus external shield	Rogers
30 (Spec)	4D	14.0	.....	.....	Arcturus
R32	X5	2.8	.....	.....	Rogers
32S	4K	2.0	32*	*Plus external shield	Rogers
32 (Spec)	4K	14.0	.....	.....	Arcturus
RK33	X9	6.3	.....	.....	Raytheon
33S	5K	2.0	33*	*Plus external shield	Rogers
34 (Octal)	5R	2.0	.....	.....	Arcturus Coronet
34M	5R	2.0	.....	.....	Rogers
34S	4M	2.0	34*	*Plus external shield	Rogers
35Z5	6AD	35.0	35Z5GT	.....	Hytron
40 (Spec)	4D	14.0	.....	.....	Arcturus
41M	7S	6.3	.....	.....	Rogers

(Cont'd)

Note: *(If a tube whose data is desired is not listed in this tube chart, see Main Tube Chart on Pages 595 to 605.)*

"SUPPLEMENTARY" RECEIVING TUBE CHARACTERISTICS CHART—(Cont'd) *(see page 594 for explanation)*

Tube Type No.	Basing Code	Fil. Volts	Replaceable By Type No.	Remarks	Mfn'r.
41S	6B	6.3	41*	*Plus external shield	Rogers
42S	6B	6.3	42*	*Plus external shield	Rogers
43 (Octal)	7AE	25.0	.....	.....	Arcturus Coronet
46S	5C	2.5	46*	*Plus external shield	Rogers
47S	5B	2.5	47*	*Plus external shield	Rogers
48 (Spec)	6A	14.0	.....	.....	Arcturus
KR48	5B	2.5	47	Obsolete	Kenrad
50L6G	7AC	50.0	50L6GT	.....	Hytron
51 (Octal)	X11	2.5	.....	.....	Arcturus Coronet
55 (Octal)	7V	2.5	.....	.....	Arcturus Coronet
56 (Octal)	6Q	2.5	.....	.....	Arcturus Coronet
57 (Octal)	7R	2.5	.....	.....	Arcturus Coronet
58 (Octal)	7R	2.5	.....	.....	Arcturus Coronet
59S	7A	2.5	59*	*Plus external shield	Rogers
75 (Octal)	7V	6.3	.....	.....	Arcturus Coronet
75M	7V	6.3	6B6G*	*Replacement recommended by RCA	Rogers
77 (Octal)	7R	6.3	.....	.....	Arcturus Coronet
77M	7R	6.3	6J7M	.....	Rogers
78 (Octal)	7R	6.3	.....	.....	Arcturus Coronet
78S	6F	6.3	78*	*Plus external shield	Rogers
80 (Octal)	5T	5.0	.....	.....	Arcturus Coronet
82V	4L	2.5	82	.....	.....
84M	6S	6.3	.....	.....	Rogers
84S	5D	6.3	84*	*Plus external shield	Rogers
85 (Octal)	7V	6.3	.....	.....	Arcturus Coronet
85L7	8AB	....	.....	.....	.....
85M	7V	6.3	.....	.....	Rogers
86	5A	6.3	.....	.....	Rogers
86M	6Q	6.3	.....	.....	Rogers
86S	5A	6.3	86*	*Plus external shield	Rogers
87S	6F	6.3	6C6	.....	Rogers
88 (Octal)	7R	5.0	.....	.....	Arcturus Coronet
88M	7R	6.3	.....	.....	Rogers
88S	6F	6.3	6D6	.....	Rogers
89RS	7N	6.3	6G7S	.....	Rogers
89S	6F	6.3	89*	*Plus external shield	Rogers
91	6N	....	.....	.....	.....
R100	4B	5.0	.....	.....	Rogers
101A	4D	5.0	01A	.....	RCA
101F	4D	4.15	.....	.....	Western Electric

(Cont'd)

Tube Type No.	Basing Code	Fil. Volts	Replaceable By Type No.	Remarks	Mfn'r.
VR105-30	4W	....	.....	Diode (Voltage Regulator)	RCA Sylvania
110	4D	7.5	10	.....	RCA
112	4D	5.0	12A	.....	RCA
112A	4D	5.0	12A	.....	RCA
117Z6GC	7AR	58.5/117	117Z6GT if C. T. is not used	Original 117Z6GT with center-tap	Sylvania
120	4D	3.3	20	.....	RCA
121B	4D	5.0	.....	.....	Canadian Wh'se.
122	4K	3.3	22	.....	RCA
124	5E	2.5	24A	.....	RCA
126	4D	1.5	26	.....	RCA
127	5A	2.5	27	.....	RCA
130	4D	2.0	30	.....	RCA
131	4D	2.0	31	.....	RCA
132	4K	2.0	32	.....	RCA
133	5K	2.0	33	.....	RCA
134	4M	2.0	34	.....	RCA
135	5E	2.5	35	.....	RCA
136A	5E	6.3	36	.....	RCA
137A	5A	6.3	37	.....	RCA
138A	5F	6.3	38	.....	RCA
139A	5F	6.3	39/44	.....	RCA
X140	4D	5.0	40	.....	.....
143D	4AB	2.5	2X2/879	.....	RCA
145	4D	2.5	45	.....	RCA
147	5B	2.5	47	.....	RCA
150	4D	7.5	50	.....	RCA
VR150-30	4W	....	.....	Diode (Voltage Regulator)	RCA Sylvania
171A	4D	5.0	71A	.....	RCA
180	4C	5.0	80	.....	RCA
UV199	4E	3.3	V99	.....	.....
UX199	4D	3.3	X99	.....	.....
200	4D	5.0	00A	.....	RCA
200A	4D	5.0	00A	.....	RCA
R200	4B	5.0	.....	.....	Rogers
201	4D	5.0	01A	.....	RCA
201A	4D	5.0	01A	.....	RCA
205D	4D	4.5	.....	.....	Western Electric
210	4D	7.5	10	.....	RCA
210T	4D	7.5	10	Triode	Sylvania
213B	4C	5.0	80	Obsolete	RCA
216B	4B	7.5	8T	Obsolete	RCA
220	4D	3.3	20	.....	RCA
222	4K	3.3	22	.....	RCA
224A	5E	2.5	24A	.....	RCA
226	4D	1.5	26	.....	RCA
227	5A	2.5	27	.....	RCA
230	4D	2.0	30	.....	RCA
232	4K	2.0	32	.....	RCA
233	5K	2.0	33	.....	RCA
234	4M	2.0	34	.....	RCA
235	5E	2.5	35	.....	RCA
236	5E	6.3	36	.....	RCA
237	5A	6.3	37	.....	RCA

(Cont'd over)

Note: *(If a tube whose data is desired is not listed in this tube chart, see Main Tube Chart on Pages 595 to 605.)*

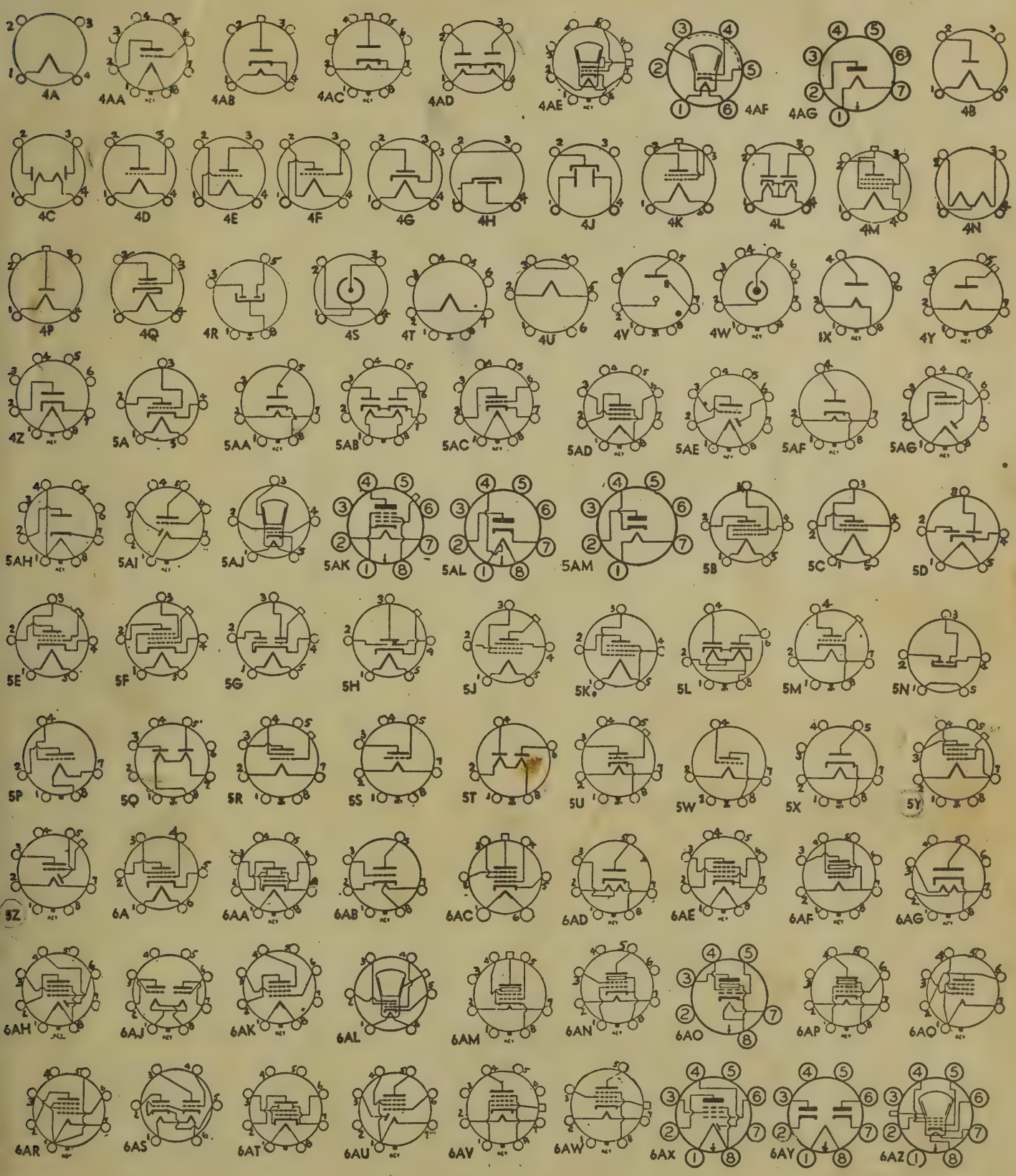
"SUPPLEMENTARY" RECEIVING TUBE CHARACTERISTICS CHART—(Cont'd) (see page 594 for explanation)

Tube Type No.	Basing Code	Fil. Volts	Replaceable By Type No.	Remarks	Mfn'r.
238	5F	6.3	38	.....	RCA
240	4D	5.0	40	.....	RCA
245	4D	2.5	45	.....	RCA
247	5B	2.5	47	.....	RCA
250	4D	7.5	50	.....	RCA
280	4C	5.0	80	.....	RCA
281	4B	7.5	81	.....	RCA
288	4AD	5.0	83V	.....	Sylvania
C299	4E	3.3	V99	.....	.....
CX299	4D	3.3	X99	.....	.....
300	4D	5.0	00A	.....	RCA
300A	4D	5.0	00A	.....	RCA
301	4D	5.0	01A	.....	RCA
301A	4D	5.0	01A	.....	RCA
310	4D	7.5	10	.....	RCA
313	4C	5.0	80	.....	RCA
313B	4C	5.0	80	.....	RCA
316	4B	7.5	81	.....	RCA
316B	4B	7.5	81	.....	RCA
322	4K	3.3	22	.....	RCA
324A	5E	2.5	24A	.....	RCA
326	4D	1.5	26	.....	RCA
327	5A	2.5	27	.....	RCA
330	4D	2.0	30	.....	RCA
331	4D	2.0	31	.....	RCA
332	4K	2.0	32	.....	RCA
333	5R	2.0	33	.....	RCA
334	4M	2.0	34	.....	RCA
335	5E	2.5	35	.....	RCA
336	5E	6.3	36	.....	RCA
337	5A	6.3	37	.....	RCA
338	5F	6.3	38	.....	RCA
340	4D	5.0	40	.....	RCA
345	4D	2.5	45	.....	RCA
347	5B	2.5	47	.....	RCA
350	4D	7.5	50	.....	RCA
371A	4D	5.0	71A	.....	RCA
374	....	....	874	Voltage regulator	RCA
376	....	....	876	Ballast	RCA
380	4C	5.0	80	.....	RCA
381	4B	7.5	81	.....	RCA
386	....	....	886	Ballast	RCA
400A	4D	5.0	00A	.....	RCA
410	4D	7.5	10	.....	RCA
412A	4D	5.0	12A	.....	RCA
415	....	....	.....	.....	RCA
420	4D	3.3	20	.....	RCA
422	4K	3.3	22	.....	RCA
424A	5E	2.5	24A	.....	RCA
426	4D	1.5	26	.....	RCA
427	5A	2.5	27	.....	RCA
430	4D	2.0	30	.....	RCA
431	4D	2.0	31	.....	RCA
432	4K	2.0	32	.....	RCA
433	5K	2.0	33	.....	RCA
434	4M	2.0	34	.....	RCA
435	5E	2.5	35	.....	RCA
436	5E	6.3	36	.....	RCA
437	5A	6.3	37	.....	RCA
438	5F	6.3	38	.....	RCA
439	5F	6.3	39/44	.....	RCA
440	4D	5.0	40	.....	RCA
441	6B	6.3	41	.....	RCA
442	6B	6.3	42	.....	RCA
444	5F	6.3	39/44	.....	RCA
445	4D	2.5	45	.....	RCA
446	5C	2.5	46	.....	RCA
447	5B	2.5	47	.....	RCA
456	5A	2.5	56	.....	RCA
457	6F	2.5	57	.....	RCA
458	6F	2.5	58	.....	RCA
471A	4D	5.0	71A	.....	RCA
480	4C	5.0	80	.....	RCA
481	4B	7.5	81	.....	RCA
482	4C	2.5	82	.....	RCA
551	5E	2.5	35	.....	RCA
801	4D	7.5	.....	.....	RCA
802	X7	6.3	.....	.....	RCA
803	5J	10.0	.....	.....	RCA
804	5J	7.5	.....	.....	RCA
807	X8	6.3	.....	.....	RCA
841	4D	7.5	.....	.....	RCA
842	4D	7.5	.....	.....	RCA
843	5A	2.5	.....	.....	RCA
866A/866	4P	2.5	866	.....	RCA
879	4AB	2.5	2X2/879	.....	.....
884	6Q	6.3	.....	.....	Raytheon
885	5A	2.5	.....	.....	Raytheon
1221	6F	6.3	.....	Pentode	Sylvania
1223	7R	6.3	.....	Pentode	Sylvania
1231	8V	6.3	.....	Pentode	Sylvania
1232	8V	6.3	7G7/1232	.....	Sylv-Ray.
1602	4D	7.5	.....	.....	RCA
1603	6F	6.3	.....	.....	RCA
1612	7T	6.3	.....	Heptode	RCA
1613	7S	6.3	.....	.....	RCA
1614	7AC	6.3	.....	.....	RCA
1620	7R	6.3	.....	.....	RCA
1622	7AC	6.3	.....	.....	RCA
1631	7AC	12.6	.....	Beam Pw'r. Amp.	RCA
1632	7AC	12.6	.....	Beam Pw'r. Amp.	RCA
1633	....	25	.....	Twin-Triode Amp.	RCA
1634	8S	12.6	.....	Twin-Triode Amp.	RCA
1852	8N	6.3	6AC7/1852	.....	Raytheon
1853	8N	6.3	6AB7/1853	.....	Raytheon
7000	7R	6.3	.....	.....	Kenrad
7700	6F	6.3	.....	.....	Kenrad
9001	7-pin miniature	6.3	.....	Det. Amp. Pentode	RCA
9002	7-pin miniature	6.3	.....	Det. Amp. Pentode	RCA
9003	7-pin miniature	6.3	.....	Amp. Pentode	RCA

(Cont'd)

Note: *(If a tube whose data is desired is not listed in this tube chart, see Main Tube Chart on Pages 595 to 605.)*

BASE-PIN & SOCKET-CONNECTION DIAGRAMS CHART FOR RMA STANDARD TUBE BASES —(Bottom Views)

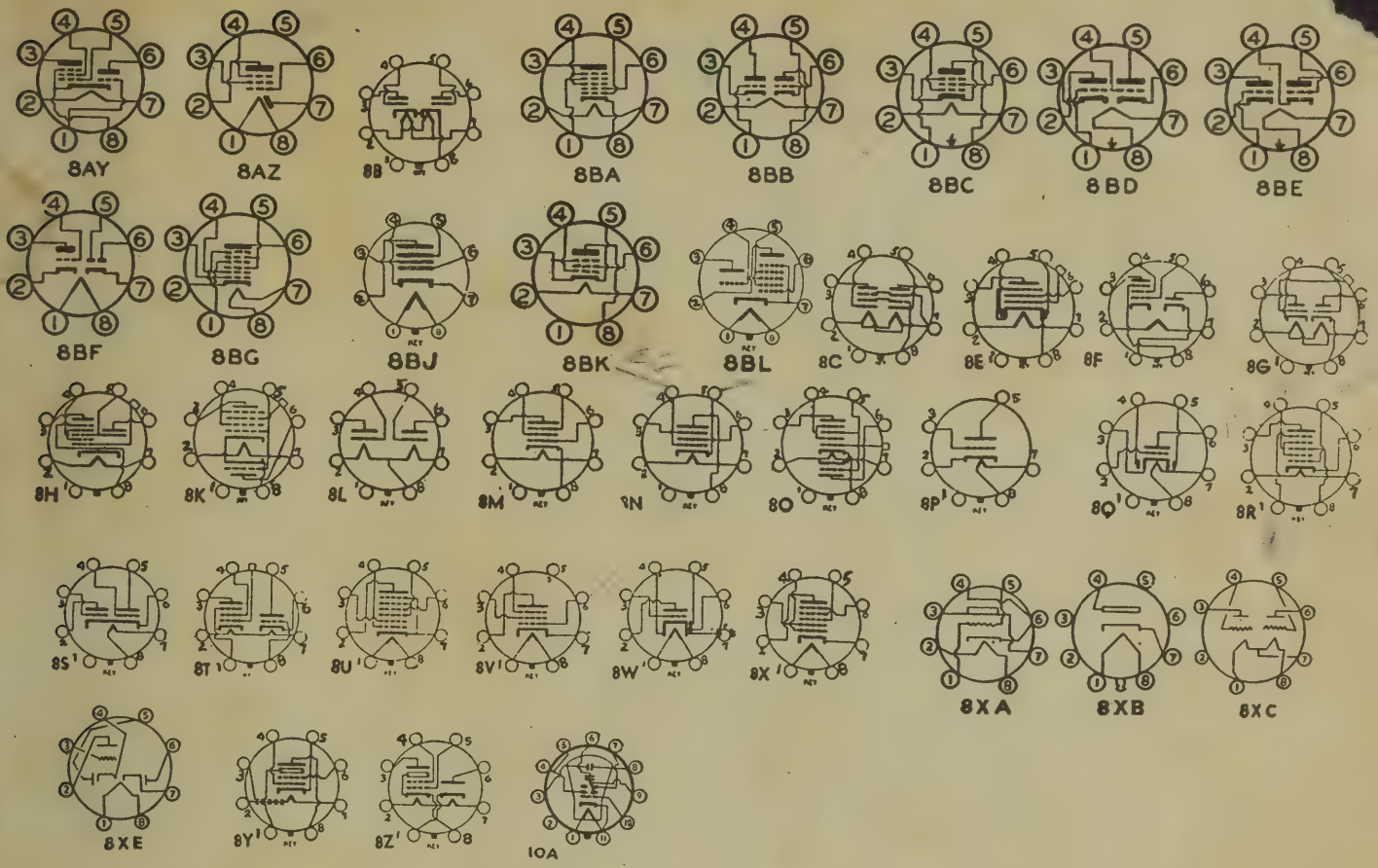


(Cont'd over)

(Cont'd)

(Bottom Views)

(Cont'd)



BASE-PIN & SOCKET CONNECTION CHART FOR "SPECIAL" (NON-RMA) TUBE BASES

Basing Code No.	Base-Pin Numbers (RMA Designation)									Type of Base	Remarks
	1	2	3	4	5	6	7	8	T.C.		
X1	Shield	Heater	Pentode Plate	Pentode Grid #2	Triode Plate	Triode Grid	Heater	Cathode & Suppressor Grid #3	Pentode Grid #1	Octal	—
X2	Shield	Heater	Pentode Plate	Pentode Grid #2	Pentode Grid #1	Triode Plate	Heater	Cathode & Suppressor Grid #3	Triode Grid #1	Octal	—
X3	Shield	Heater	Ptv	Target	Grid #1	Kt	Heater	Koy	—	Octal	—
X4	Shield	Heater	Plate	Grid #2	Diode #1	Diode #2	Heater	Cathode & Grid #3	Grid #1	Octal	—
X5	—	Plate	Grid	Cathode	—	—	—	—	—	4-Prong	Heater Leads Terminate At Two Top Caps
X6	Filament	—	Grid	Filament	—	—	—	—	Plate	4-Prong	—
X7	Heater	Internal Shield	Grid #2	Grid #1	Grid #3	Cathode	Heater	—	Plate	7-Prong	—
X8	Heater	Grid #2	Grid #1	Cathode & Beam Forming Plates	Heater	—	—	—	Plate	5-Prong	—
X9	Heater	Cathode A	Plate A	Grid B	Plate B	Cathode B	Heater	—	Grid A	7-Prong	—
X10	—	Cathode	Jumper To #7	—	Anode	—	Jumper To #3	—	—	Octal	—
X11	—	Heater	Plate	—	Grid #2	—	Heater	Cathode	Grid #1	Octal	—

TUBE TYPES FOR SUBSTITUTION

THE Government Limitation order which restricts the manufacture of many types of radio receiving tubes hitherto available makes necessary the substitution of other suitable available types of tubes in receivers in order to keep them in operation throughout the emergency period. Although service men should continue with original tube types wherever it is possible, they will be faced more and more with the necessity for tube substitution.

This chart, which presents a correlation of tube types for substitution is included here as a guide for simplifying the task of making correct tube substitutions. In order to make the selection for substitution as large as possible, two reference columns are given for each listed type — tubes having *"Equivalent"* characteristics and tubes having *"Similar"* characteristics.

"EQUIVALENT" TYPES — tubes listed here as *"Equivalent"* are those which have electrical characteristics and circuit applications *equivalent* to the listed types.

"SIMILAR" TYPES—tubes listed here as *"Similar"* are those which have electrical characteristics and circuit applications *similar* to the listed types.

It is not implied that all tubes listed here as *"Equivalents"* are interchangeable. However, many of them are directly interchangeable, or can be made interchangeable by a slight change in the circuit constants. Such tubes are marked with an asterisk(*). Types not marked with an asterisk in the "Equivalent" column may be made interchangeable by changing the socket or filament rating.

The *"Similar"* tubes are not interchangeable unless marked with an asterisk, but as the circuit applications and characteristics are similar these types can be made to function as substitutes if the proper receiver circuit wiring changes are made, thus giving a wide selection of tube types from which to choose.

When making any substitution changes it will be necessary to refer also to the Operating Characteristics and Basing Diagram Charts of *Sect. 22* so that the full benefit of the changes will be realized and no tube will be used in such a way that it will be abused.

In some cases, realignment of tuned circuits may be necessary, particularly where capacitances differ. In general, it is always wise to check and realign the tuned circuits of a receiver in which tube substitutions have been made.

Also additional external shielding may be required, especially when replacing metal tubes with glass tubes.

(Read instructions above carefully before using chart)

This chart is a war time expedient to be consulted when exact replacements are not available.

Type	Style	Service	Characteristics Equivalent To	Characteristics Similar To
0A4G	G	Rectifier	.....	.....
0Z4	Metal	Rectifier	0Z4G*	6X5GT/G
0Z4G	G	Rectifier	0Z4*	6X5GT/G
01A§	Glass	Amplifier	.....	30
1A4P	Glass	R-F Amplifier	1A4T*	1D5GP
1A4T	Glass	R-F Amplifier	1A4P*	.....
1A5G§	GT	Power Amplifier	1A5GT/G*	1C5GT,/G 1G5G
1A5GT§	GT	Power Amplifier	1A5GT/G*	1C5GT/G, 1G5G
1A5GT/G	GT	Power Amplifier	1A5G*,1A5GT*	1C5GT/G, 1G5G
1A6	Glass	Pentagrid Converter	1D7G	1C6
1A7G§	G	Pentagrid Converter	1A7GT/G*	1C7G, 1D7G, 1A6
1A7GT§	GT	Pentagrid Converter	1A7GT/G*	1A6, 1C7G, 1D7G
1A7GT/G	GT	Pentagrid Converter	1A7G*,1A7GT*	1A6, 1C7G, 1D7G

(Cont'd)

Type	Style	Service	Characteristics Equivalent To	Characteristics Similar To
1B4P§	Glass	R-F Amplifier	1E5GP	32
1B5/25S	Glass	Duodiode Detector	1H6G	.....
1B7G§	G	Pentagrid Converter	1B7GT/G*	1C6, 1C7G
1B7GT§	GT	Pentagrid Converter	1B7GT/G*	1C6, 1C7G
1B7GT/G	GT	Pentagrid Converter	1B7G*, 1B7GT*	.....
1C5G§	G	Power Output Amp.	1C5GT/G*	1A5GT/G, 1G5G
1C5GT§	GT	Power Amplifier	1C5GT/G*	1A5GT/G, 1G5G
1C5GT/G	GT	Power Amplifier	1C5G*, 1C5GT*	1A5GT/G, 1G5G
1C6	Glass	Pentagrid Converter	1C7G	1A6
1C7G	G	Pentagrid Converter	1C6	1A6, 1A7GT/G, 1D7G
1D5GP	G	R-F Amplifier	1A4P	1N5GT/G, 34
1D5GT	G	R-F Amplifier	1A4P	34
1D7G§	G	Pentagrid Converter	1A6	1A7GT/G, 1C6, 1C7G
1D8GT	GT	Diode Tri. Pent.	1LB4 and 1LH4	.....

(Cont'd)

Reprinted by Courtesy SYLVANIA ELECTRIC PRODUCTS INC.

—(Cont'd)

Type	Style	Service	Characteristics Equivalent To	Characteristics Similar To
1E4G§	G	Triode	1LE3	.....
1E5GP§	G	R-F Amplifier	1B4P	32
1E7G§	G	Power Output Pent.	.....	(Two 1F4's)
1F4	Glass	Power Output Pent.	1F5G	33, 1G5G, 1J5G
1F5G	G	Power Output Pent.	1F4	33, 1G5G, 1J5G
1F6	Glass	Duodiode Pentode	1F7G	1B5/25S, 1H6G
1F7G	G	Duodiode Pentode	1F6	1B5/25S, 1H6G
1G4G§	G	Triode	1G4GT/G*	30, 1H4G
1G4GT§	GT	Triode	1G4GT/G*	30, 1H4G
1G4GT/G	GT	Triode	1G4G*, 1G4GT*	30, 1H4G
1G5G§	G	Power Output Pent.	.....	1F4, 1F5G
1G6G§	G	Power Amplifier	1G6GT/G*	19, 1J6G
1G6GT§	GT	Power Amplifier	1G6GT/G*	19, 1J6G
1G6GT/G	GT	Power Amplifier	1G6G*, 1G6GT*	19, 1J6G
1H4G	G	Amplifier	30	.....
1H5G§	G	Diode Triode Amp.	1H5GT/G*	1B5/25S
1H5GT§	GT	Diode Triode	1H5GT/G*	1B5/25S
1H5GT/G	GT	Diode Triode	1H5G*, 1H5GT*	1B5/25S
1H6G	G	Duodiode Detector	1B5/25S	1F6
1J5G§	G	Power Output Pent.	.....	1F4, 1F5G, 1G5G, 33
1J6G	G	Power Output Amp.	19ƒ	(Two 31's)
1LA4	Lock-In	Power-Amplifier	1A5GT/G	1C5GT/G
1LA6	Lock-In	Pentagrid Converter	1A7GT/G	1A6
1LB4	Lock-In	Power Amplifier	.....	1T5GT
1LC5§	Lock-In	R-F Amplifier	1LN5*	1N5GT/G
1LC6	Lock-In	Pentagrid Converter	1LA6*, 1A7GT/G	1A6
1LD5	Lock-In	Diode Pentode	.....	1S5
1LE3	Lock-In	Triode	1E4G	.....
1LH4	Lock-In	Diode Triode	1H5GT/G	1B5/25S
1LN5	Lock-In	R-F Amplifier	1LC5*	1N5GT/G
1N3G§	G	R-F Amplifier	1N5GT/G*	1A4P, 1D5GP
1N5GT§	GT	R-F Amplifier	1N5GT/G*	1LN5, 1LC5
1N5GT/G	GT	R-F Amplifier	1N5G*, 1N5GT*	1LN5, 1LC5
1N6G§	G	Diode Pentode	.....	.....
1P5G§	G	R-F Amplifier	1P5GT/G*	1N5GT/G
1P5GT§	GT	R-F Amplifier	1P5GT/G*	1N5GT/G
1P5GT/G	GT	R-F Amplifier	1P5G*, 1P5GT*	1N5GT/G
1Q5G§	G	Power Amplifier	1Q5GT/G*	1C5GT/G
1Q5GT§	GT	Power Amplifier	1Q5GT/G*	1C5GT/G
1Q5GT/G	GT	Power Amplifier	1Q5G*, 1Q5GT*	1C5GT/G
1R5	Miniature	Converter	.....	1A6, 1A7GT/G
1S4	Miniature	Power Amplifier	.....	1Q5GT/G, 1C5GT/G
1S5	Miniature	Diode Pentode	1LD5	.....
1T4	Minature	R-F Amplifier	1N5GT/G, 1LN5	.....
1T5GT	GT	Power Amplifier	.....	1C5GT/G, 1LB4
1V	Glass	Rectifier	.....	19Z3
2A3	Glass	Power Output Tri.	6A3ƒ, 6B4Gƒ	45
2A4G	G	Gas Triode	.....	2051
2A5	Glass	Power Output Pent.	6F6Gƒ, 42ƒ	47
2A6	Glass	Duodiode Detector	6Q7Gƒ, 75ƒ	.....
2A7, 2A7S§	Glass	Pentagrid Converter	6A7ƒ, 6A7Sƒ	.....
2B7§, 2B7S§	Glass	Duodiode Pentode	6B7ƒ, 6B7Sƒ	.....
2E5§	Glass	Tuning Indicator	6E5ƒ	.....
2S/4S§	Glass	Duodiode Detector	.....	.....
2W3§	Glass	Rectifier	.....	80
2Z2/G84§	Glass	Rectifier	.....	.....
3A8GT	GT	Diode Triode Pent.	1H5GT/G, and 1N5GT/G	.....
3LF4	Lock-In	Power Amplifier	3Q5GT/G	.....
3Q5G§	G	Power Amplifier	3Q5GT/G*	3LF4
3Q5GT§	GT	Power Amplifier	3Q5GT/G*	3LF4
3Q5GT/G	GT	Power Amplifier	3Q5G*, 3Q5GT*	3LF4
3S4	Miniature	Power Amplifier	.....	3Q5GT/G
5T4§	Metal	Rectifier	5U4G*	5V4G*, 83V
5U4G	G	Rectifier	5Z3, 5X4G	5T4
5V4G	G	Rectifier	83V	5T4
5W4§	Metal	Rectifier	5W4GT/G*	5Y3GT/G*, 5Z4, 80
5W4G§	G	Rectifier	5W4GT/G*	5Y3GT/G*
5W4GT§	GT	Rectifier	5W4GT/G*	5Y3GT/G*
5W4GT/G	GT	Rectifier	5W4*, 5W4G* 5W4GT*	5Y3GT/G*
5X4G	G	Rectifier	5Z3, 5U4G	.....
5Y3G§	G	Rectifier	5Y3GT/G*	5Z4*
5Y3GT§	GT	Rectifier	5Y3GT/G*, 80, 5Y4G	5Z4*
5Y3GT/G	GT	Rectifier	5Y3G*, 5Y3GT*	5Z4*
5Y4G§	G	Rectifier	5Y3GT/G*, 80	5Z4
5Z3	Glass	Rectifier	5U4G, 5X4G	83

(Cont'd)

Type	Style	Service	Characteristics Equivalent To	Characteristics Similar To
5Z4	Metal	Rectifier	.....	5Y3GT/G*, 5Y4G
6A3	Glass	Power Output Tri.	2A3ƒ, 6B4G	45
6A4/LA§	Glass	Power Output Pent.	.....	41
6A5G§	G	Power Output Tri.	.....	6A3, 6B4G*
6A6	Glass	Power Output Amp.	6N7, 6N7G, 53ƒ	.....
6A7, 6A7S§	Glass	Pentagrid Converter	6A8†, 6A8G, 2A7ƒ, 2A7Sƒ	.....
6A8	Metal	Pentagrid Converter	6A7†, 6A8G†*	6D8G
6A8G	G	Pentagrid Converter	6A7, 6A8†*	6D8G
6A8GT	GT	Pentagrid Converter	6A8*, 6A8G*	6A7
6AB5/6N5	Glass	Tuning Indicator	.....	6E5
6AB7/1853	Metal	Pentode Amplifier	.....	7H7, 7L7
6AC5G§	G	Power Amplifier	6AC5GT/G*	.....
6AC5GT§	GT	Power Amplifier	6AC5GT/G*	.....
6AC5GT/G	GT	Power Amplifier	6AC5G*, 6AC5GT*	.....
6AC7/1852	Metal	Pentode Amplifier	.....	7V7
6AD6G§	G	Tuning Indicator	6AF6G*	6E5
6AD7G	G	Triode Pentode	.....	.....
6AE5G§	G	Amplifier	6AE5GT/G*	.....
6AE5GT§	GT	Amplifier	6AE5GT/G*	6J5GT/G
6AE5GT/G	GT	Amplifier	6AE5G*, 6AE5GT*	6J5GT/G
6AE6G§	G	Double Triode	.....	.....
6AE7GT§	GT	Twin Triode	.....	.....
6AF5G§	G	Amplifier	.....	.....
6AF6G§	G	Tuning Indicator	6AD6G*	.....
6AG7	Metal	Pentode Amplifier	.....	.....
6B4G	G	Power Output Tri.	6A3, 2A3ƒ	6A5G, 45
6B5	Glass	Power Output Amp.	6N6G	42
6B7, 6B7S§	Glass	Duodiode Pentode	6B8G	6B8†
6B8	Metal	Duodiode Pentode	6B8G*	6B7
6B8G	G	Duodiode Pentode	6B8†	6B7
6C5	Metal	Triode Amplifier	6C5GT/G*	6J5GT/G, 6L5G, 6P5GT/G, 37, 76
6C5G§	G	Triode Amplifier	6C5†, 6C5GT/G*	6J5GT/G, 6L5G, 6P5GT/G, 37, 76
6C5GT§	GT	Triode Amplifier	6C5GT/G*	.....
6C5GT/G	GT	Triode Amplifier	6C5*, 6C5G*, 6C5GT*	.....
6C6	Glass	R-F Amplifier	6D7, 1221, 1223	6J7, 6J7G, 6W7G, 77*
6C7§	Glass	Duodiode Tri. Det.	6R7GT/G	75, 85
6C8G	G	Duotriode Amplifier	.....	6F8G
6D6	Glass	R-F Amplifier	6E7, 6U7G	6K7, 6K7G, 6S7G 78*
6D7§	Glass	R-F Amplifier	6C6, 1221, 1223	6J7, 6J7G, 6W7G, 77
6D8G	G	Pentagrid Converter	.....	6A7, 6A8, 6A8G
6E5	Glass	Tuning Indicator	2E5ƒ	6G5, 6T5, 6U5/6G5
6E6§	Glass	Power Output Amp.	.....	.....
6E7§	Glass	R-F Amplifier	6D6, 6U7G	6K7, 6K7G, 6S7G, 78
6F5	Metal	Triode Amplifier	6F5GT/G*	6K5GT/G
6F5G§	G	Triode Amplifier	6F5GT/G*	6K5GT/G
6F5GT§	GT	High Mu Triode	6F5GT/G*	6K5GT/G
6F5GT/G	GT	Triode Amplifier	6F5*, 6F5G*, 6F5GT*	6K5GT/G
6F6	Metal	Power Output Pent.	6F6G*	42, 2A5ƒ
6F6G	G	Power Output Pent.	6F6*	42, 2A5ƒ
6F7, 6F7S§	Glass	Triode Pent. Amp.	6P7G	.....
6F8G	G	Twin Triode	6F8*, 7N7	6C8G (two 6J5GT/G's)
6G6G	G	Power Output Pent.	.....	.....
6H4GT	GT	Rectifier	.....	.....
6H6	Metal	Duodiode	6H6GT/G†*	7A6
6H6G§	G	Duodiode	6H6GT/G*	7A6
6H6GT§	GT	Double Diode	6H6GT/G*	7A6
6H6GT/G	GT	Double Diode	6H6*, 6H6G*, 6H6GT*	7A6
6J5	Metal	Triode Amplifier	6J5GT/G†*	6C5GT/G, 6L5G, 37, 76
6J5G§	G	Triode Amplifier	6J5GT/G*	6C5GT/G, 6L5G, 6P5GT/G, 37, 76
6J5GT§	GT	Triode	6C5GT/G*, 6J5GT/G*	.....
6J5GT/G	GT	Triode	6J5*, 6J5G*, 6J5GT*	6C5GT/G*, 6P5GT/G
6J7	Metal	R-F Amplifier	6J7GT†*, 77†	6C6, 6W7G
6J7G	G	R-F Amplifier	6J7GT†*, 77	6C6, 6W7G
6J7GT	GT	Pentode Amplifier	6J7G*, 7C7	.....
6J8G	G	Triode Hep. Con.	.....	6K8
6K5G§	G	Triode Amplifier	6K5GT/G*	6F5GT/G
6K5GT§	GT	Amplifier	6K5GT/G*	6F5GT/G
6K5GT/G	GT	Amplifier	6K5G*, 6K5GT*	6F5GT/G
6K6G§	G	Power Output Pent.	6K6GT/G*, 41	6F6GT/G, 42

(Cont'd)

SYMBOLS: *—Indicates direct interchangeability. In some cases realignment of tuned circuits may be necessary particularly where capacitances differ.
ƒ—Equivalent Characteristics except for filament rating. †—Characteristics same as listed type except capacitances. §—Types no longer manufactured.

(Cont'd over)

—(Cont'd)

Type	Style	Service	Characteristics Equivalent To	Characteristics Similar To
6K6GT§	GT	Power Amplifier	6K6GT/G*, 41	6F6GT/G, 42
6K6GT/G	GT	Power Amplifier	6K6G*, 6K6GT*	6F6GT/G, 42
6K7	Metal	R-F Amplifier	6K7G†*, 78†	6D6, 6S7G, 6U7G
6K7G	G	R-F Amplifier	6K7†*, 78	6D6, 6S7G, 6U7G
6K7GT	GT	Pentode Amplifier	6K7G*, 77, 7A7	.....
6K8	Metal	Triode Hex. Con.	6K8GT, 6K8G*	6J8G
6K8G	G	Triode Hex. Con.	6K8*, 6K8GT*	.....
6K8GT	GT	Triode Hex. Con.	6K8G*	.....
6L5G	G	Triode Amplifier	.....	6C5GT/G, 6J5GT/G, 6P5GT/G, 76
6L6	Metal	Power Output Amp.	6L6G*	.....
6L6G	G	Power Output Amp.	6L6*	.....
6L7	Metal	Pentagrid Mixer	6L7G†*, 1612	.....
6L7G	G	Pentagrid Mixer	6L7†*, 1612	.....
6N6G	G	Power Output Amp.	6B5	6F6G, 42
6N7	Metal	Power Output Amp.	6A6, 6N7G*	53#
6N7G§	G	Power Output Amp.	6A6, 6N7*	53#
6P5G§	G	Triode Amplifier	56#, 76, 6P5GT/G*	37, 6C5GT/G, 6J5GT/G, 6L5G
6P5GT§	GT	Triode Amplifier	76, 6P5GT/G*	37, 6C5GT/G, 6J5GT/G, 6L5G
6P5GT/G	GT	Triode Amplifier	6P5G*, 6P5GT*	37, 6C5GT/G, 6J5GT/G, 6L5G
6P7G§	G	Triode Pent. Amp.	6F7, 6F7S	.....
6Q7	Metal	Duodiode-Triode	6Q7G†*	6T7G, 75
6Q7G	G	Duodiode Triode	6Q7†*	6T7G, 75
6Q7GT	GT	Duodiode Triode	6Q7G*	6T7G, 75
6R7	Metal	Duodiode Triode	6R7GT/G†*	6V7G, 85
6R7G§	G	Duodiode Triode	6R7GT/G†*	6V7G, 85
6R7GT§	GT	Duodiode Triode	6R7GT/G*	6V7G, 85
6R7GT/G	GT	Duodiode Triode	6R7*, 6R7G*, 6R7GT*	6V7G, 85
6S7	Metal	Pentode Amplifier	6S7G*	.....
6S7G§	G	Pentode Amplifier	6S7*	6D6, 6J7, 6K7G, 6U7G, 78
6SA7	Metal	Pentagrid Converter	6SA7GT/G*, 7Q7	.....
6SA7GT§	GT	Pentagrid Converter	6SA7GT/G*, 7Q7	.....
6SA7GT/G	GT	Pentagrid Converter	6SA7*, 6SA7GT*	.....
6SC7	Metal	Twin Triode	7F7	.....
6SD7GT	GT	Pentode Amplifier	.....	7H7, 7L7
6SF5	Metal	High Mu Triode	6SF5GT*, 7B4	6F5GT/G
6SF5GT	GT	High Mu Triode	6SF5G*, 7B4	.....
6SF7	Metal	Diode-Pentode	7E7	6B8G, 6B7
6SG7	Metal	R-F Pentode	7W7	.....
6SH7	Metal	R-F Pentode	7W7	.....
6SJ7	Metal	Pentode Amplifier	6SJ7GT*, 7C7	.....
6SJ7GT	GT	Pentode Amplifier	6SJ7*, 7C7	.....
6SK7	Metal	Pentode Amplifier	6SK7GT/G*, 7A7	.....
6SK7GT§	GT	Pentode Amplifier	6SK7GT/G*, 7A7	.....
6SK7GT/G	GT	Pentode Amplifier	6SK7*, 6SK7GT*	.....
6SL7GT	GT	Duo-Triode	7F7	6SC7
6SN7GT	GT	Duo-Triode	7N7, 6F8G	Two 6J5GT/G's
6SQ7	Metal	Duodiode Triode	6SQ7GT/G*, 7B6	.....
6SQ7GT§	GT	Duodiode Triode	6SQ7GT/G*, 7B6	.....
6SQ7GT/G	GT	Duodiode Triode	6SQ7*, 6SQ7GT*	.....
6SR7	Metal	Duodiode Triode	6R7GT/G, 7E6	.....
6SS7	Metal	R-F Pentode	6SK7GT/G	7A7
6ST7	Metal	Duodiode Trl.	6SR7, 6R7GT	6SQ7GT/G
6T5§	Glass	Tuning Indicator	6U5/6G5*	6E5
6T7G§	G	Duodiode Tri. Amp.	.....	6Q7, 6Q7G, 75
6U5/6G5	Glass	Tuning Indicator	6G5*, 6T5*	6E5
6U7G	G	R-F Amplifier	6D6, 6E7	6K7, 6K7G*, 6S7G
6V6	Metal	Power Output Amp.	6V6GT/G*	.....
6V6G§	G	Power Output Amp.	6V6GT/G*	.....
6V6GT§	GT	Power Amplifier	6V6GT/G*, 7C5	.....
6V6GT/G	GT	Power Amplifier	6V6*, 6V6G*, 6V6GT*	.....
6V7G§	G	Duodiode Triode	55#, 85	6R7GT/G
6W7G	G	R-F Amplifier	.....	6C6, 6J7, 6J7G, 77
6X5§	Metal	Rectifier	6X5GT/G*, 84	0Z4G
6X5G§	G	Rectifier	6X5GT/G*, 84	0Z4G
6X5GT§	GT	Rectifier	6X5GT/G* 84	0Z4G
6X5GT/G	GT	Rectifier	6X5*, 6X5G*, 6X5GT*	0Z4G
6Y5§	Glass	Rectifier	.....	6X5GT/G, 84
6Y6G§	G	Power Output Amp.	.....	.....
6Y7G	G	Power Output Amp.	79	6Z7G
6Z5§	Glass	Rectifier	.....	.....
6ZY5G	G	Rectifier	.....	.....

(Cont'd)

Type	Style	Service	Characteristics Equivalent To	Characteristics Similar To
6Z7G	G	Power Output Amp.	.....	6Y7G, 79
7A4	Lock-In	Triode	6J5GT/G	.....
7A5	Lock-In	Power Amplifier	.....	35A5, 7B5
7A6	Lock-In	Duodiode	6H6GT/G	.....
7A7	Lock-In	Pentode Amplifier	6SK7GT/G	.....
7A8	Lock-In	Octode Converter	6A8GT	.....
7B4	Lock-In	Triode	6F5GT/G	.....
7B5	Lock In	Power Amplifier	6K6GT/G, 41	.....
7B6	Lock-In	Duodiode Triode	75, 6SQ7GT/G	.....
7B7	Lock-In	Pentode Amplifier	7A7*, 78	6SK7GT/G
7B8	Lock-In	Pentagrid Converter	7A8*, 6A8GT	.....
7C5	Lock-In	Power Amplifier	6V6GT/G	.....
7C6	Lock-In	Duodiode Triode	7B6*, 6SQ7GT/G	.....
7C7	Lock-In	Pentode Amplifier	6SJ7GT	.....
7E6	Lock-In	Duodiode Triode	6SR7	.....
7E7	Lock-In	Duodiode Pentode	6B8G	.....
7F7	Lock-In	Twin Triode	6SC7	.....
7G7/1232	Lock-In	Pentode Amplifier	.....	7V7
7H7	Lock-In	Pentode Amplifier	.....	7L7
7J7	Lock-In	Triode Hep. Con.	6J8G	.....
7L7	Lock-In	Pentode Amplifier	.....	7H7
7N7	Lock-In	Twin Triode	6F8G	.....
7Q7	Lock-In	Pentagrid Converter	6SA7GT/G	.....
7S7	Lock-In	Triode Hep. Con.	.....	7J7
7V7	Lock-In	Pentode Amplifier	7W7*	.....
7W7	Lock-In	Pentode Amplifier	7V7*	.....
7Y4	Lock-In	Rectifier	6X5GT/G	.....
7Z4	Lock-In	Rectifier	.....	7Y4
10	Glass	Power Output Trl.	210T*	50
12A	Glass	Power Output Trl.	.....	01A, 71A
12A5§	Glass	Power Output Pent.	.....	.....
12A7	Glass	Rectifier & Amplifier	.....	25A7GT/G
12A8G§	G	Pentagrid Converter	12A8GT/G*	.....
12A8GT§	GT	Pentagrid Converter	12A8GT/G*	.....
12A8GT/G	GT	Pentagrid Converter	12A8G*, 12A8GT*	.....
12B8GT	GT	Triode-Pent.	.....	.....
12C8	Metal	Duodiode Pentode	6B8 (Pentode Section)	.....
12F5GT	GT	High Mu Triode	6F5GT/G	.....
12J5GT	GT	Triode	6J5GT/G	.....
12J7GT§	GT	Pentode Amplifier	12J7GT/G*	.....
12J7GT/G	GT	Pentode Amplifier	12J7GT*	.....
12K7G§	G	Pentode Amplifier	6K7G, 12K7GT/G*	.....
12K7GT§	GT	Pentode Amplifier	6K7G, 12K7GT/G*	.....
12K7GT/G	GT	Pentode Amplifier	12K7G*, 12K7GT*	.....
12K8	Metal	Tri-Hexode Con.	6K8#	.....
12Q7G§	G	Duo-Diode Triode	12Q7GT/G*	6Q7G
12Q7GT§	GT	Duodiode Triode	12Q7GT/G*	6Q7GT
12Q7GT/G	GT	Duodiode Triode	12Q7G*, 12Q7GT*	6Q7GT
12SA7	Metal	Pentagrid Converter	12SA7GT/G*	6SA7
12SA7GT§	GT	Pentagrid Converter	12SA7GT/G*	6SA7GT
12SA7GT/G	GT	Pentagrid Converter	12SA7*, 12SA7GT*	6SA7GT
12SC7	Metal	Twin-Triode Amp.	.....	6SC7, 7F7
12SF5	Metal	High Mu Triode	12F5GT, 12SF5GT*	.....
12SF5GT	GT	High Mu Triode	12F5GT, 12SF5G*	.....
12SF7	Metal	Diode-Pentode	7E7	6B8G, 6B7
12SG7	Metal	R-F Pentode	14W7	.....
12SH7	Metal	R-F Pentode	14W7	.....
12SJ7	Metal	R-F Amplifier	12SJ7GT*	6SJ7GT
12SJ7GT	GT	R-F Amplifier	12SJ7*	6SJ7GT
12SK7	Metal	R-F Amplifier	12SK7GT/G*	6SK7GT/G
12SK7GT§	GT	R-F Amplifier	12SK7GT/G*	6SK7GT/G
12SK7GT/G	GT	R-F Amplifier	12SK7*, 12SK7GT*	6SK7GT/G
12SL7GT	GT	Duotriode	14F7	.....
12SN7GT	GT	Duotriode	14N7	Two 12J5GT's
12SQ7	Metal	Duodiode Triode	12SQ7GT/G*	6SQ7GT/G
12SQ7GT§	GT	Duodiode Triode	12SQ7GT/G*	6SQ7GT/G
12SQ7GT/G	GT	Duodiode Triode	12SQ7*, 12SQ7GT*	6SQ7GT/G
12SR7	Metal	Duodiode Triode	.....	6SR7GT
12Z3	Glass	Rectifier	.....	1V
14A4§	Lock-In	Triode Amplifier	7A4	6J5GT/G
14A7/12B7	Lock-In	Pentode Amplifier	7A7	6SK7GT/G
14B6§	Lock-In	Duodiode Triode	7B6	6SQ7GT/G
14B8§	Lock-In	Pentagrid Converter	7B8	6A8GT
14C5§	Lock-In	Power Amplifier	7C5	6V6GT/G
14C7	Lock-In	Pentode Amplifier	7C7	6SJ7GT
14E6§	Lock-In	Duodiode Triode	7E6	6SR7GT
14F7§	Lock-In	Twin Triode Amp.	7F7	6SL7GT

(Cont'd)

SYMBOLS: *—Indicates direct interchangeability. In some cases realignment of tuned circuits may be necessary particularly where capacitances differ.
#—Equivalent Characteristics except for filament rating. †—Characteristics same as listed type except capacitances. §—Types no longer manufactured.

(Cont'd)

Type	Style	Service	Characteristics Equivalent To	Characteristics Similar To
14H7	Lock-In	Pentode Amplifier	7H7	.....
14J7	Lock-In	Triode Hex. Con.	7J7	6J8G
14N7§	Lock-In	Twin Triode	7N7	6F8G
14Q7	Lock-In	Pentagrid Converter	7Q7	6SA7GT/G
14S7	Lock-In	Triode Hex. Con.	7S7	6J8G
14W7	Lock-In	Pentode Amplifier	7W7	.....
14Y4§	Lock-In	Rectifier	7Y4	6X5GT/G
15§	Glass	R-F Pentode	.....	24A
18§	Glass	Power Output Amp.	.....	2A5, 42
19	Glass	Power Output Amp.	1J6G†	(Two 31's)
20§	Glass	Power Output Amp.	.....	X99
22§	Glass	R-F Amplifier	.....	1B4P, 32
24A, 24S§	Glass	R-F Amplifier	.....	35/51, 35S/51S
25A6§	Metal	Power Output Amp.	25A6GT/G*, 43	.....
25A6G§	G	Power Output Amp.	25A6GT/G*, 43	.....
25A6GT§	GT	Pentode Amplifier	25A6GT/G*, 43	.....
25A6GT/G	GT	Pentode Amplifier	25A6*, 25A6G*, 25A6GT*	.....
25A7G§	G	Rectifier & Amplifier	25A7GT/G*	12A7
25A7GT§	GT	Pentode-Rectifier	25A7GT/G*	.....
25A7GT/G	GT	Pentode-Rectifier	25A7G*, 25A7GT*	.....
25AC5G§	G	Power Triode	25AC5GT/G*	.....
25AC5GT§	GT	Power Triode	25AC5GT/G*	.....
25AC5GT/G	GT	Power Triode	25AC5G*, 25AC5GT*	.....
25B5§	Glass	Power Amplifier	25N6G	.....
25B6G§	G	Power Output Amp.	.....	25A6G, 43
25B8GT§	GT	Pentode Triode	.....	.....
25C6G	G	Power Amplifier	6Y6G	.....
25L6§	Metal	Power Output Amp.	25L6GT/G*	.....
25L6G§	G	Power Output Amp.	25L6GT/G*	.....
25L6GT§	GT	Power Amplifier	25L6GT/G*	.....
25L6GT/G	GT	Power Amplifier	25L6*, 25L6G*, 25L6GT*	.....
25Y5§	Glass	Rectifier	25Z5	.....
25Z5	Glass	Rectifier	25Z6GT/G	.....
25Z6	Metal	Rectifier	25Z3, 25Z6GT/G*	.....
25Z6G§	G	Rectifier	25Z5, 25Z6GT/G*	.....
25Z6GT§	GT	Rectifier	25Z5, 25Z6GT/G*	.....
25Z6GT/G	GT	Rectifier	25Z6*, 25Z6G*, 25Z6GT*	.....
26	Glass	Amplifier	.....	.....
27, 27S§	Glass	Amplifier	.....	56*, 56S
30	Glass	Amplifier	1H4G	.....
31§	Glass	Power Output Amp.	.....	.....
32	Glass	R-F Amplifier	.....	1A4T, 1D5GT
32L7GT	GT	Tetrode, Rectifier	.....	70L7GT
33	Glass	Power Output Amp.	.....	1F4, 1F5G, 1G5G, 1J5G
34	Glass	R-F Amplifier	.....	1D5GT, 1A4P, 1A4T, 1D5GP, 1N5GT/G
35/51	Glass	R-F Amplifier	35S, 51S	24A
35S/51S§	Glass	R-F Amplifier	35/51	24S
35A5	Lock-In	Power Amplifier	35L6GT/G	.....
35L6G§	G	Power Amplifier	35L6GT/G*	25L6GT/G
35L6GT§	GT	Power Amplifier	35L6GT/G*	25L6GT/G
35L6GT/G	GT	Power Amplifier	35L6G*, 35L6GT*	25L6GT/G 50L6GT
35Y4	Lock-In	Rectifier	35Z5GT/G	.....
35Z3	Lock-In	Rectifier	35Z4GT	.....
35Z4GT	GT	Rectifier	35Z3	.....
35Z5G§	G	Rectifier	35Z5GT/G*, 35Y4	.....
35Z5GT§	GT	Rectifier	35Z5GT/G*, 35Y4	.....
35Z5GT/G	GT	Rectifier	35Z5G*, 35Z5GT*	.....
36	Glass	R-F Amplifier	.....	6C6, 6J7
37	Glass	Triode Amplifier	.....	6C5GT/G, 6J5GT/G, 6P5GT/G, 76*
38	Glass	Power Output Amp.	.....	6K6GT/G, 41
39/44	Glass	R-F Amplifier	.....	6D6, 6K7, 6K7G, 6S7G, 78
40§	Glass	Amplifier	.....	.....
40Z5/45Z5GT	GT	Rectifier	35Z5GT/G	.....

(Cont'd)

Type	Style	Service	Characteristics Equivalent To	Characteristics Similar To
41	Glass	Power Output Pent.	6K6G	38, 42
42	Glass	Power Output Pent.	2A5†, 6F6G	6F6
43	Glass	Power Output Pent.	25A6GT/G	48
45	Glass	Power Output Tri.	.....	2A3
46	Glass	Power Output Amp.	.....	.....
47	Glass	Power Output Pent.	.....	2A5
48§	Glass	Power Output Tet.	.....	43
49§	Glass	Power Output Tet.	.....	.....
50	Glass	Power Output Tri.	.....	10
50A5	Lock-In	Power Amplifier	50L6GT	.....
50C6G§	G	Power Amplifier	.....	25C6G
50L6GT	GT	Power Amplifier	.....	25L6GT/G 35L6GT/G
50Y6G§	G	Rectifier	50Y6GT/G*	35Y4
50Y6GT§	GT	Rectifier	50Y6GT/G*	35Y4
50Y6GT/G	GT	Rectifier	50Y6G*, 50Y6GT*	35Y4
50Z7G§	G	Rectifier	.....	.....
53	Glass	Power Output Amp.	6A6†, 6N7†, 6N7G†	.....
55§, 55S§	Glass	Duodiode Triode	6V7G†, 85†	.....
56, 56S§	Glass	Triode Amplifier	76†	27, 27S
56AS§	Glass	Triode Amplifier	76†	.....
57, 57S§	Glass	R-F Amplifier	6C6†	77
57AS§	Glass	R-F Amplifier	6C6†	.....
58, 58S§	Glass	R-F Amplifier	6D6†, 6E7†, 6U7G†	.....
58AS§	Glass	R-F Amplifier	6D7†, 6E7†, 6U7G†	78
59	Glass	Power Output Amp.	.....	.....
70A7GT	GT	Rect. Pentode	.....	70L7GT
70L7GT	GT	Tetrode, Rectifier	32L7GT	.....
71A	Glass	Power Output Tri.	.....	12A
75, 75S	Glass	Duodiode Triode	2A6†	6Q7, 6Q7G, 6T7G
76	Glass	Triode Amplifier	6P5GT/G, 56†	6L5G, 6C5GT/G, 6J5GT/G, 37*
77	Glass	R-F Amplifier	6J7†, 6J7G	6C6*, 6W7G
78	Glass	R-F Amplifier	6K7†, 6K7G	6D6*, 6S7G
79	Glass	Power Output Amp.	6Y7G	.....
80	Glass	Rectifier	5Y3GT/G, 5Y4G	.....
81	Glass	Rectifier	.....	.....
82	Glass	Rectifier	.....	.....
83	Glass	Rectifier	.....	83V, 5U4G, 5X4G, 5Z3, 5Z4G
83V	Glass	Rectifier	5Z4G	83
84/6Z4	Glass	Rectifier	6X5GT/G	.....
85	Glass	Duodiode Triode	6V7G, 55†	6R7GT/G
85AS§	Glass	Duodiode Triode	.....	6R7GT/G, 85
89§	Glass	Power Output Amp.	.....	.....
V99§	Glass	Triode Amplifier	.....	X99, 30†
X99§	Glass	Triode Amplifier	.....	V99, 20, 30†
182B/482B§	Glass	Power Output Amp.	.....	183/483*, 71A
183/483§	Glass	Power Output Amp.	.....	182B/482B*, 71A
117L7GT§	GT	Tetrode, Rectifier	117L7/M7GT*	32L7GT, 70L7GT
117M7GT§	GT	Tetrode, Rectifier	117L7/M7GT*	32L7GT, 70L7GT
117L7/M7GT	GT	Tetrode, Rectifier	117L7GT*, 117M7GT*	32L7GT, 70L7GT
117N7GT	GT	Tetrode, Rectifier	.....	32L7GT, 70L7GT
117P7GT	GT	Rect. Pentode	.....	117L7/M7GT
117Z6G§	G	Rectifier	117Z6GT/G*	.....
117Z6GT§	GT	Rectifier	117Z6GT/G*	.....
117Z6GT/G	GT	Rectifier	117Z6G*, 117Z6GT*	.....
210-T	Glass	Power Output Amp.	10*	.....
485§	Glass	Triode Amplifier	.....	27
864	Glass	Triode Amplifier	.....	.....
1221	Glass	Non-mic. Amplifier	1223, 6C6	6J7, 6J7G, 6W7G, 77
1223	G	Non-mic. Amplifier	1221, 6C6	6J7, 6J7G, 6W7G, 77
1231	Special	Triple Grid Amp.	.....	.....
1612	Metal	Non-mic. Amplifier	6L7, 6L7G†	.....
2051	G	Gas Tetrode	.....	2A4G
XXD	Lock-In	Twin Triode	14AF7*	14N7
XXFM	Lock-In	Duodiode Triode	.....	.....
XXL	Lock-In	Triode	.....	7A4

SYMBOLS: *—Indicates direct interchangeability. In some cases realignment of tuned circuits may be necessary particularly where capacitances differ.
†—Equivalent Characteristics except for filament rating. ‡—Characteristics same as listed type except capacitances. §—Types no longer manufactured.

SPECIAL-PURPOSE TUBE OPERATING CHARACTERTISTICS AND BASING DIAGRAM CHARTS

THE following chart presents information on certain tubes closely allied to receiving tubes but customarily tabulated and identified by the term "special purpose." These tubes are of particular interest for applications involving specialized performance requirements.

Fifteen of the socket-connection diagrams specified in the fourth column from the left are those illustrated at the end of the chart. The rest are standard RMA basing diagrams that will be found in the chart on pages 609-611.

RCA TYPE	NAME	DIMENSIONS SOCKET CONNECTIONS		CATHODE TYPE AND RATING			USE Values to right give operating conditions and characteristics for indicated typical use	PLATE SUPPLY VOLTS	GRID BIAS ■ VOLTS	SCREEN SUPPLY VOLTS	SCREEN CURRENT MA.	PLATE CURRENT MA.	A-C PLATE RESISTANCE OHMS	TRANSCONDUCTANCE (GRID-PLATE) μMHOS	AMPLIFICATION FACTOR	LOAD FOR STATED POWER OUTPUT OHMS	POWER OUTPUT WATTS	RCA TYPE
		DIMEN.	S.C.	C.T.	VOLTS	AMP.												
DETECTORS, AMPLIFIERS, INDICATORS																		
12A6	BEAM POWER AMPLIFIER	C2	7AC	H	12.6	0.15	CLASS A AMPLIFIER	250	−12.5	250	3.5	30	70000	3000	—	7500	3.4	12A6
864	AMPLIFIER TRIODE See Note A	C8	4D	F	1.1	0.25	CLASS A AMPLIFIER	135	− 9.0	—	—	3.5	12700	645	8.2	—	—	864
954	SHARP CUT-OFF PENTODE Acorn Type	A3	FIG. 1	H	6.3	0.15	CLASS A AMPLIFIER	90 250	− 3.0 − 3.0	90 100	0.5 0.7	1.2 2.0	1§ 1+§	1100 1400	—	—	—	954
							BIAS DETECTOR	250✖	− 6.0	100	Plate current to be adjusted to 0 1 ma with no signal.							
955	AMPLIFIER TRIODE Acorn Type	A0a	FIG. 2	H	6.3	0.15	CLASS A AMPLIFIER	90 250	− 2.5 − 7.0	—	—	2.5 6.3	14700 11400	1700 2200	25 25	—	—	955
							R-F AMPLIFIER, OSCILLATOR—Class C	D C Plate Volts, 180, Grid Volts, −35 (approx), D-C Plate Current, 7 ma , D-C Grid Current, 1 5 ma , Power Output at 5 meters, 0 5 watt, (approx)										
956	REMOTE CUT-OFF PENTODE Acorn Type	A3	FIG. 1	H	6.3	0.15	CLASS A AMPLIFIER	250	− 3.0	100	2.7	6.7	700000	1800	—	—	—	956
							MIXER IN SUPERHETERODYNE	250	−10.0	100	—	—	Oscillator Peak Volts = 7 0					
957	AMPLIFIER TRIODE Acorn Type	A0a	FIG. 3	F	1.25	0 05	CLASS A AMPLIFIER	135	− 5.0	—	—	2.0	24600	650	16	—	—	957
958	AMPLIFIER TRIODE Acorn Type	A0a	FIG. 3	F	1.25	0.10	CLASS A AMPLIFIER	135	− 7.5	—	—	3.0	10000	1200	12	—	—	958
959	SHARP CUT-OFF PENTODE Acorn Type	A3	FIG. 4	F	1.25	0.05	CLASS A AMPLIFIER	135	− 3 0	67.5	0 4	1.7	800000	600	—	—	—	959
1603	SHARP CUT-OFF PENTODE See Note A	D13	6F	H	6.3	0.3	AMPLIFIER DETECTOR	For other characteristics, refer to Type 6J7 in Chart II										1603
1609	AMPLIFIER PENTODE See Note A	D5	5K	F	1.1	0.25	CLASS A AMPLIFIER	135	− 1.5	67.5	0 65	2.5	400000	725	—	—	—	1609
1612	PENTAGRID AMPLIFIER See Note A	C1	7T	H	6.3	0.3	AMPLIFIER	For other characteristics, refer to Type 6L7 in Chart II										1612
1620	SHARP CUT-OFF PENTODE See Note A	C1	7R	H	6.3	0.3	AMPLIFIER	For other characteristics, refer to Type 6J7 in Chart II										1620
1621	POWER AMPLIFIER PENTODE See Note B	C2	7S	H	6.3	0.7	PUSH-PULL TRIODE □ CLASS A AMPLIFIER	327.5	Cath. Resistor, 500 Ohms			55.0♠	—	—	—	5000	2.0†	1621
							PUSH-PULL PENTODE CLASS A AMPLIFIER	300	−30.0	300	6.5♠	38.0♠	—	—	—	4000	5.0†	
1622	BEAM POWER AMPLIFIER See Note B	D7	7AC	H	6.3	0.9	PUSH-PULL CLASS A AMPLIFIER	300	−20.0	250	4 0♠	86 0♠	—	—	—	4000	10.0†	1622
1629	ELECTRON-RAY TUBE	D2	FIG. 7	H	12.6	0.15	VISUAL INDICATOR	For other characteristics, refer to Type 6E5 in Chart II										1629
1631	BEAM POWER AMPLIFIER See Note C	D7	7AC	H	12.6	0.45	AMPLIFIER	Max Plate Dissipation = 16 watts For other characteristics, refer to Type 6L6 in Chart II										1631
1632	BEAM POWER AMPLIFIER See Note C	C2	7AC	H	12.6	0.6	AMPLIFIER	Characteristics are the same as those of the 25L6-GT/G (see Chart II) within the following ratings of the 1632 Plate Volts, 117, Screen Volts, 117, Plate Dissipation, 5 5 watts										1632
1633	TWIN-TRIODE AMPLIFIER See Note D	C3	8BD	H	25.0	0.15	AMPLIFIER	For other characteristics, refer to Type 12SN7-GT in Chart II										1633
1634	TWIN-TRIODE AMPLIFIER See Note D	B3	8S	H	12.6	0.15	AMPLIFIER	For other characteristics, refer to Type 12SC7 in Chart II.										1634
1635	CLASS B TWIN-TRIODE AMPLIFIER	C3	G-8B‡	H	6.3	0.6	CLASS B AMPLIFIER Sustained Signal	300	0	—	—	Power Output is for one tube at stated plate-to-plate load				12000	10.4	1635
							CLASS B AMPLIFIER Variable Signal	400	0	—	—	Power Output is for one tube at stated plate-to-plate load.				14000	17.0	
1642	TWIN-TRIODE AMPLIFIER	D9	FIG. 8	H	6.3	0.6	EACH UNIT AS AMPLIFIER	250	−16.5	—	—	8.3	7600	1375	10.4	—	—	1642
1644	TWIN-PENTODE POWER AMPLIFIER	C3	FIG. 9	H	12.6	0.15	EACH UNIT AS AMPLIFIER	180	− 9.0	180	2.8	13.0	160000	2150	—	10000	1.0	1644
1851	TELEVISION AMPLIFIER-PENTODE	C7	7R	H	6.3	0.45	AMPLIFIER	For other characteristics, refer to Type 6AC7/1852 in Chart II										1851
9001	SHARP CUT-OFF H-F PENTODE Midget Type	A2	FIG. 10	H	6.3	0.15	CLASS A AMPLIFIER	90 250	− 3.0 − 3.0	90 100	0.5 0.7	1.2 2.0	1§ 1+§	1100 1400•	—	—	—	9001
							MIXER IN SUPERHETERODYNE	100 250	− 5.0 − 5.0	100 100	—	—	Oscillator Peak Volts = 4					
9002	H-F TRIODE Midget Type	A2	FIG. 11	H	6.3	0.15	CLASS A AMPLIFIER	90 250	− 2.5 − 7.0	—	—	2.5 6.3	14700 11400	1700 2200	25 25	—	—	9002
9003	REMOTE CUT-OFF H-F PENTODE Midget Type	A2	FIG. 10	H	6.3	0.15	CLASS A AMPLIFIER	250	− 3.0	100	2.7	6.7	700000	1800	—	—	—	9003
							MIXER IN SUPERHETERODYNE	100 250	−10.0 −10.0	100 100	—	—	Oscillator Peak Volts = 9.					
9004	U-H-F DIODE Acorn Type	A0a	FIG. 5	H	6.3	0.15	DETECTOR RECTIFIER	Maximum A-C Voltage . . . 117 Volts, RMS Maximum D-C Output Current . . . 5 Milliamperes Resonant Frequency . . . 850 Megacycles, Approx.										9004
9005	U-H-F DIODE Acorn Type	A0a	FIG. 6	H	3.6	0.165	DETECTOR RECTIFIER	Maximum A-C Voltage . . . 117 Volts, RMS Maximum D-C Output Current . . . 1 Milliampere Resonant Frequency . . . 1500 Megacycles, Approx.										9005

Note A For applications critical as to microphonics.
Note B For applications requiring continuity of service.
Note C: For applications critical as to uniformity of characteristics.
Note D: For applications critical as to matching of the two units.

Reprinted by Courtesy Radio Corp. of America—RCA Victor Division

(Cont'd)

—(Cont'd)

RCA TYPE	NAME	DIMENSIONS SOCKET CONNECTIONS DIMEN.	S. C.	CATHODE TYPE AND RATING C. T.	VOLTS	AMP.	USE Values to right give operating conditions and characteristics for indicated typical use	PLATE SUPPLY VOLTS	GRID BIAS ■ VOLTS	SCREEN SUPPLY VOLTS	SCREEN CURRENT MA.	PLATE CURRENT MA.	A-C PLATE RESISTANCE OHMS	TRANSCONDUCTANCE (GRID-PLATE) μMHOS	AMPLIFICATION FACTOR	LOAD FOR STATED POWER OUTPUT OHMS	POWER OUTPUT WATTS	RCA TYPE
GAS-TRIODES & GAS-TETRODES																		
0A4-G	GAS TRIODE Starter-Anode Type	D3	FIG. 15	Cold	—	—	RELAY SERVICE	Peak Cathode Current, 100 max ma. D-C Cathode Current, 25 max. ma. Grid Drop, 60 approx. volts. Anode Drop, 70 approx volts.										0A4-G
884	GAS-TRIODES Control-Grid Type	D3	G-601	H	6.3	0.6	AS SWEEP OSCILLATOR	Max Instantaneous Anode Volts, 300 Max. Peak Anode Ma., 300 Max Peak Volts between any two electrodes, 350 Max. Average Anode Ma.: below 200 cycles, 3 ma., above 200 cycles, 2 ma.										884
885	GAS-TRIODES Control-Grid Type	D5	5A	H	2.5	1.4	GRID-CONTROLLED RECTIFIER	Max Peak Volts between any two electrodes, 350 Max. Peak Anode Ma., 300 Max. Average Anode Ma , 75										885
2050	GAS-TETRODE Control-Grid Type	D3	FIG 12	H	6.3	0.6	GRID-CONTROLLED RECTIFIER	Max Peak Forward Volts, 650. Max Peak Inverse Volts, 1300. Shield Grid Volts, 0 Max. Peak Anode Ma., 500 Max Average Anode Ma., 100 Grid Resistor, 0.01 min , 10 max. megohms. Tube Voltage Drop, 8 volts, approx										2050
2051	GAS-TETRODE Control-Grid Type	D3	FIG 12	H	6.3	0.6	GRID-CONTROLLED RECTIFIER	Max Peak Forward Volts, 350 Max. Peak Inverse Volts, 700. Shield Grid Volts, 0 Max Peak Anode Ma , 375. Max. Average Anode Ma., 75 Grid Resistor, 0 01 min., 10 max megohms. Tube Voltage Drop, 14 volts, approx										2051
VOLTAGE REGULATORS																		
VR 75-30	VOLTAGE REGULATOR	D3	FIG. 13	Cold	—	—	REGULATOR	Min D-C Starting Supply Volts, 105 D-C Operating Volts, 75					D-C Operating Ma., 5-30.					VR 75-30
VR 105-30	VOLTAGE REGULATOR	D3	FIG. 13	Cold	—	—	REGULATOR	Min D-C Starting Supply Volts, 127. D-C Operating Volts, 105					D-C Operating Ma., 5-30					VR 105-30
VR 150-30	VOLTAGE REGULATOR	D3	FIG. 13	Cold	—	—	REGULATOR	Min D-C Starting Supply Volts, 180. D-C Operating Volts, 150					D-C Operating Ma., 5-30					VR 150-30
874	VOLTAGE REGULATOR	E4	FIG. 14	Cold	—	—	REGULATOR	Min D-C Starting Supply Volts, 125. D-C Operating Volts, 90					D-C Operating Ma., 10-50					874
991	VOLTAGE REGULATOR	A0b	—	Cold	—	—	REGULATOR	Min D-C Starting Supply Volts, 87 D-C Operating Volts, 48-67					Peak Current, 3 ma., max. Max. Current (Continuous), 2 ma					991

✖ Applied through plate resistor of 250000 ohms.
♠ For two tubes.
□ Grid # 2 tied to plate
† Power output is for two tubes at stated plate-to-plate load.
§ Megohms.

Socket Connections

(See also pages 609-611)

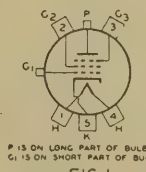


FIG. 1

FIG. 2

FIG. 3

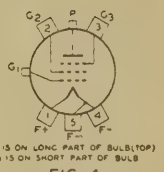


FIG. 4

FIG. 5

FIG. 6

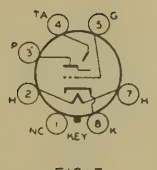


FIG. 7

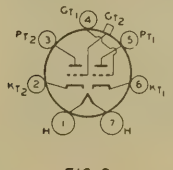


FIG. 8

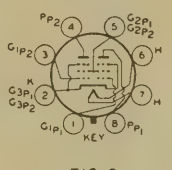


FIG. 9

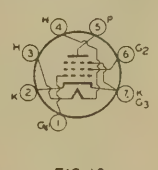


FIG. 10

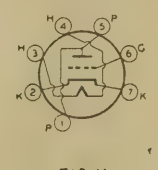


FIG. 11

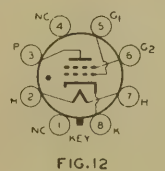


FIG. 12

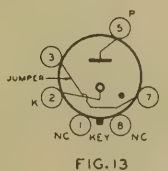


FIG. 13

FIG. 14

FIG. 15

TRANSMITTING TUBE OPERATING CHARACTERISTICS*

TRIODES

Type	Max. Plate Dissipation Watts	Filament Volts	Filament Amps.	Approx. Interelectrode Capacitances MMF. G to F	G to P	P to F	Ampl. Factor	Max. Plate Volts	Max. Plate Current Ma.	Max. D. C. Grid Current Ma.	Base	Max. Overall Length	Max. Overall Dia.	Socket Connections
NU-114B††	2.5	1.25	0.145	1.4	1.85	1.45	12	180	15	3	5-pin O	2 7/16	1 5/16	8-A3
NU-615	3.5	6.3	0.15	1.5	1.7	1.7	22	300	20	4	5-pin O	2 7/16	1 5/16	8-A7
NU-1626φ	5.0	12.6	0.25	3.2	4.4	3.4	5.0	250	25	8.2	8-pin O	4 1/8	1 5/16	8-A4
NU-34 xx	10	6.3	0.8	4.2	2.7	0.8	13	300	80	20	7-pin M	5 5/8	1 13/16	7-D3
NU-75H††	15	6.3	2.5	1.8		0.95	10	450	100	20	5-pin O	5	1 5/8	8-A3
NU-801/A801	20	7.5	1.25	4.5	6.0	1.5	8	600	70	15	4-pin M	5 3/8	2 1/16	4-B
NU-30Z	30	6.3	2.25	6.0	4.85	1.0	87	850	90	25	4-pin M	5 3/4	2 7/16	4-B5
NU-31Z xx	30	6.3	2.5	5.0	5.5	1.9	45	500	150	30	4-pin M	5 3/4	2 1/16	4-D
NU-809φ	30	6.3	2.5	5.7	6.7	0.9	50	1000	125		4-pin M	6 5/8	2 7/16	4-B2
NU-1623	30	6.3	2.5	5.7	6.7	0.9	20	1000	100	25	4-pin M	6 5/8	2 7/16	4-B2
NU-40T	40	7.5	2.25	6.2	6.3	1.1	25	1000	125	25	4-pin M	6 5/8	2 7/16	4-B2
NU-40TZ	40	7.5	2.5	6.2	6.3	1.1	80	1000	125	30	4-pin M	6 5/8	2 7/16	4-B2
NU-811φ	55	6.3	4.0	5.5	5.5	0.6	160	1500	150	50	4-pin M	6 5/8	2 7/16	4-B2
NU-812φ	55	6.3	4.5	5.3	5.3	0.8	29	1500	150	35	4-pin M	6 5/8	2 7/16	4-B2
NU-60	60	10	2.5	5.5	6.6	2.9	20	1600	150	35	4-pin M	5	1 13/16	4-B3
NU-51A	65	7.5	3.5	7.1	7.0	1.1	25	1000	175	25	4-pin M	6 5/8	2 7/16	4-B2
NU-51Z	65	7.5	3.5	7.1	7.0	1.1	85	1000	175	35	4-pin M	6 5/8	2 7/16	4-B5
NU-845	100	10	3.25	5.0	11.5	3.5	5.3	1250	150	60	4-pin J	7 7/8	2 5/16	3-A1
NU-211	100	10	3.25	5.0	13.5	2.6	12	1250	175	50	4-pin J	7 7/8	2 5/16	3-A1
NU-838	100	10	3.25	5.3	8.2	3.1	50	1250	175	70	4-pin J	7 7/8	2 5/16	3-A1
NU-805	125	10	3.25	5.3	8.2	2.7	50	1500	210	70	4-pin J	8 1/2	2 5/16	3-A2
NU-200	150	10	3.4	5.2	5.8	1.2	18	2500	200	50	4-pin J	9 1/2	4	3-A3
NU-300	200	11-12	4.0	6.0	6.5	1.4	23	3000	275	60	4-pin J	9 7/8	4 1/8	3-A3

BEAM TYPE TETRODES

Type	Max. Plate Dissipation Watts	Max. Screen Dissipation Watts	Filament Volts	Filament Amps.	Approx. Interelectrode Capacitances in Mmf. G to F	G to P	P to F	Max. Plate Volts	Max. Screen Voltage	Base	Max. Overall Length	Max. Overall Dia.	Socket Connections
NU-832 xx	15	5.0	6.3 12.6	1.6 0.8	7.5	0.05†††	3.8	400	250	Special	3 7/16	2 3/8	9-B
NU-807	30	3.5	6.3	0.9	11.0	0.2	7.0	750	300	5-pin M	5 3/4	2 1/16	5-B2
NU-1625φ	30	3.5	12.6	0.45	11.0	0.2†††	7.0	750	300	7-pin M	5 3/4	2 1/16	7-D4
NU-69††	40	5.0	6.3	1.5	15.35	0.19	7.35	600	300	5-pin M	5 3/4	2 1/16	5-D
NU-829 xx	40	10	6.3 12.6	2.25 1.125	15.2	0.1†††	6.5	500	225	Special	4 1/16	2 3/8	9-B
NU-813	100	22	10	5.0	16.3	0.2†††	14	2000	400	7-pin J	7 1/2	2 5/16	7-C1

RECTIFIERS—Half-Wave Type

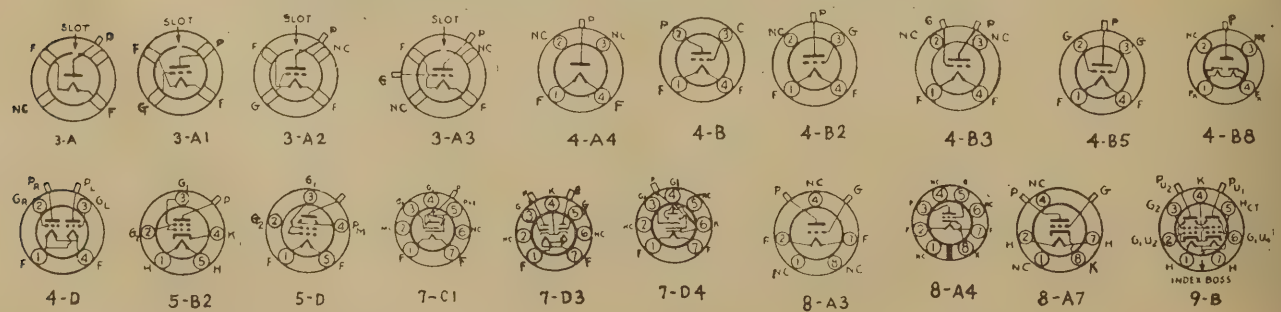
Type	Vacuum or Mercury Vapor	D.C. Average Plate Current Maximum	Filament Volts	Filament Amps.	Max. Peak Inverse Voltage	Max. Peak Plate Current Ma.	Base	Max. Overall Length	Max. Overall Dia.	Socket Connections
NU-816	M	125	2.5	2.0	5000	500	4-pin S	4 1/16	1 5/16	4-A4
NU-866Jr.	M	125	2.5	2.0	5000	500	4-pin S	4 1/16	1 5/16	4-A4
NU-872	M	1250	5	10.0	7500	5000	4-pin J	8 1/2	2 5/16	3-A
NU-872A	M	1250	5	6.75	10,000	5000	4-pin J	8 1/2	2 5/16	3-A
NU-866A/866	M	250****	2.5	5.0	10,000	1000	4-pin M	6 5/8	2 1/16	4-A4
NU-836	V	250	2.5	5.0	5000	1000	4-pin M	6 7/16	2 7/16	4-B8

NOTES:

* At 112 Mc.
† Calc. at 33% Efficiency for 100% Modulation.
xx Dual Tetrode—values for both sections in push-pull.
†† Instant heating filament for mobile use.
††† With external shielding.
*** Choke input.
**** Condenser input.
φ Ratings are Intermittent Com'l and Amateur Svc.

All Ratings are for continuous commercial service unless otherwise indicated.

TRANSMITTING TUBE DIAGRAMS (Bottom Views are Shown)



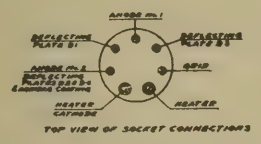
Reprinted by courtesy the Engineering Dept. National Union Radio Corp.

CATHODE RAY TUBE OPERATING CHARACTERISTICS

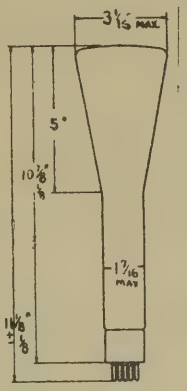
3AP1/906-P1 3AP4/906-P4

Three Inch Videotron

INDIRECTLY HEATED CATHODE
HEATER VOLTAGE: 2.5 Volts
HEATER CURRENT: 2.1 Amps.
ELECTROSTATIC DEFLECTION



7AN-0-0



CHARACTERISTICS:	P1—Green	P4—White	
High-Voltage Anode (No. 2)	1500 max.		Volts
Focusing Anode (No. 1)	1000 max.		Volts
Cut-off Control Grid Voltage	−50 ±50%		
Peak Voltage Between High-Voltage Anode and Any Deflecting Plate	600 max.		Volts
Fluorescent Screen Input Power Per Sq. Cm.	10 max.		Milliwatts

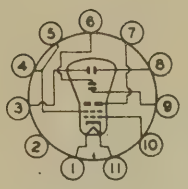
TYPICAL OPERATION:					
Anode No. 2 Voltage	600	800	1200	1500	Volts
Anode No. 1 Voltage	170	230	345	430	Volts
Cut-off Grid Voltage	Adjust to Give Suitable Luminous Spot				
Deflection Sensitivity:					
Plates D1 & D2	0.55	0.41	0.27	0.22	MM/Volt D.C.
Plates D3 & D4	0.58	0.44	0.29	0.23	MM/Volt D.C.

CAPACITANCE:		
Grid-to-all-other-Electrodes	9	μμf

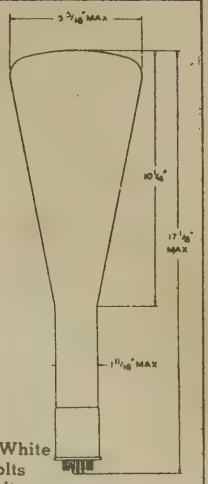
5BP1/1802-P1 5BP4/1802-P4

Long Five Inch Videotron

INDIRECTLY HEATED CATHODE
HEATER VOLTAGE: 6.3 Volts
HEATER CURRENT: 0.6 Amps.
ELECTROSTATIC DEFLECTION



PIN No. 1—Heater
PIN No. 2—No Connection Pin
PIN No. 3—Deflecting Plate D1
PIN No. 4—Anode No. 1
PIN No. 5—Tied to Pin No. 4
PIN No. 6—Deflecting Plate D4
PIN No. 7—Anode No. 2
PIN No. 8—Deflecting Plate D2
PIN No. 9—Deflecting Plate D3
PIN No. 10—Grid
PIN No. 11—Heater and Cathode



CHARACTERISTICS:	P1—Green	P4—White	
High Voltage Anode (No. 2)	2000 max.		Volts
Focusing Anode (No. 1)	500 max.		Volts
Control Grid Voltage	Never Positive		
Cut-off Grid Voltage	−40 ±50%		Volts
Fluorescent-Screen Input Power Per Sq. Cm.	10 max.		Milliwatts

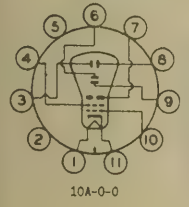
TYPICAL OPERATION:				
Anode No. 2 Voltage	1200	1500	2000	Volts
Anode No. 1 Voltage	250	310	425	Volts
Grid Voltage	Adjust for Suitable Luminous Spot			
Deflection Sensitivity:				
D1 & D2	0.5	0.4	0.3	MM/Volt D.C.
D3 & D4	0.55	0.44	0.33	MM/Volt D.C.

CAPACITANCE:		
Grid-to-all-other-Elements	9	μμf

5AP4/1805-P4

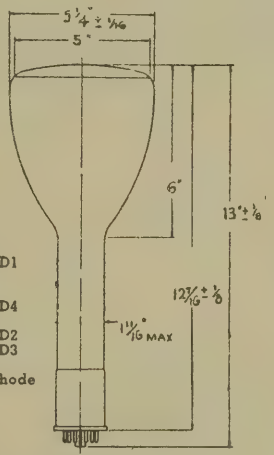
Short Five Inch Videotron

INDIRECTLY HEATED CATHODE
HEATER VOLTAGE: 6.3 Volts
HEATER CURRENT: 0.6 Amps.
ELECTROSTATIC DEFLECTION



10A-0-0

PIN No. 1—Heater
PIN No. 2—No Connection
PIN No. 3—Deflecting Plate D1
PIN No. 4—Anode No. 1
PIN No. 5—Do not use
PIN No. 6—Deflecting Plate D4
PIN No. 7—Anode No. 2
PIN No. 8—Deflecting Plate D2
PIN No. 9—Deflecting Plate D3
PIN No. 10—Grid
PIN No. 11—Heater and Cathode



CHARACTERISTICS:			
High Voltage Anode (No. 2)	2000 max.		Volts
Focusing Anode (No. 1)	700 max.		Volts
Control Grid Voltage	Never Positive		
Cut-off Grid Voltage	−57 ±30%		Volts
Fluorescent-Screen Input Power Per Sq. Cm.	10 max.		Milliwatts
Fluorescent Color	White		

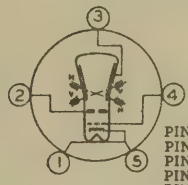
TYPICAL OPERATION:			
Anode No. 2 Voltage	1500	2000	Volts
Anode No. 1 Voltage	425	575	Volts
Grid Voltage	Adjust for Suitable Luminous Spot		
Deflection Sensitivity:			
D1 & D2	0.23	0.17	MM/Volt D.C.
D3 & D4	0.28	0.21	MM/Volt D.C.

CAPACITANCE:		
Grid-to-all-other-Elements	12 max.	μμf

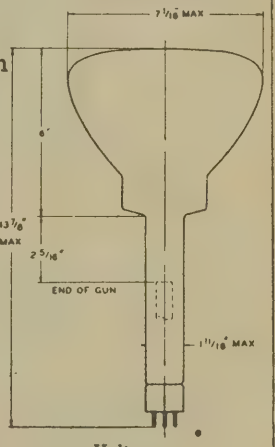
7AP4

Short Seven Inch Videotron

INDIRECTLY HEATED CATHODE
HEATER VOLTAGE: 2.5 Volts
HEATER CURRENT: 2.1 Amps.
ELECTROMAGNETIC DEFLECTION



PIN No. 1—Heater
PIN No. 2—Anode No. 1
PIN No. 3—Anode No. 2
PIN No. 4—Grid
PIN No. 5—Heater and Cathode



CHARACTERISTICS:			
High-Voltage Anode (No. 2)	3500 max.		Volts
Focusing Anode (No. 1)	1000 max.		Volts
Cut-off Control Grid Voltage (No. 1)	−30 ±50%		
Fluorescent-Screen Input Power Per Sq. Cm.	2.5 max.		Milliwatts
Fluorescent Color	White		

TYPICAL OPERATION:		
Anode No. 2 Voltage	3500	Volts
Anode No.1 Voltage approx.	675	Volts
Control Grid Voltage	Adjust for Suitable Luminous Spot	
Control Grid, Peak-to-Peak Signal Voltage	15	Volts

CAPACITANCE:		
Grid to all other Electrodes	12	μμf

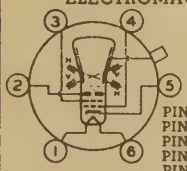
(Cont'd over)

Reprinted by courtesy the Engineering Dept. National Union Radio Corp.

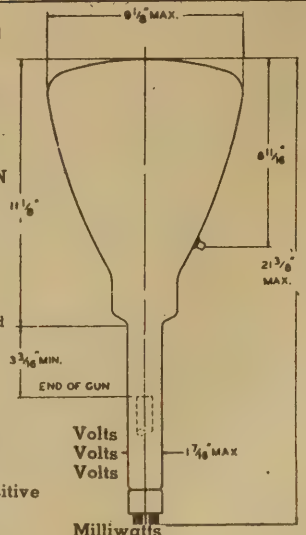
9AP4/1804-P4

Nine Inch Videotron

INDIRECTLY HEATED CATHODE
HEATER VOLTAGE: 2.5 Volts
HEATER CURRENT: 2.1 Amps.
ELECTROMAGNETIC DEFLECTION



PIN No. 1—Heater
PIN No. 2—Anode No. 1
PIN No. 3—Accelerating Grid
PIN No. 4—Control Grid
PIN No. 5—Cathode
PIN No. 6—Heater
CAP—Anode No. 2

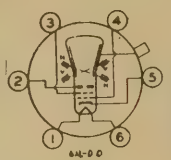


CHARACTERISTICS:			
High-Voltage Anode (No. 2)	7000 max.		Volts
Focusing Anode (No. 1)	1900 max.		Volts
Accelerating Grid (No. 2)	250 max.		Volts
Control Grid (No. 1)	Never Positive		
Fluorescent-Screen Input Power Per Sq. Cm.	10 max.		Milliwatts
Fluorescent Color	White		
TYPICAL OPERATION:			
Anode No. 2 Voltage	6000	7000	Volts
Anode No. 1 Voltage approx.	1225	1425	Volts
Accelerating Grid Voltage	250	250	Volts
Control Grid Voltage	Adjust for Suitable Luminous Spot		
Control Grid Voltage for Cut-off	−40 ±50%	−40 ±50%	Volts
Control Grid, Peak-to-Peak Voltage	25	25	Volts
CAPACITANCE:			
Grid No. 1 to all other Elements	12		μμf

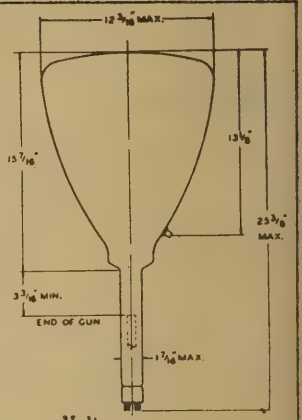
12AP4/1803-P4

Twelve Inch Videotron

INDIRECTLY HEATED CATHODE
HEATER VOLTAGE: 2.5 Volts
HEATER CURRENT: 2.1 Amps.
ELECTROMAGNETIC DEFLECTION



PIN No. 1—Heater
PIN No. 2—Anode No. 1
PIN No. 3—Accelerating Grid
PIN No. 4—Control Grid
PIN No. 5—Cathode
PIN No. 6—Heater
CAP—Anode No. 2



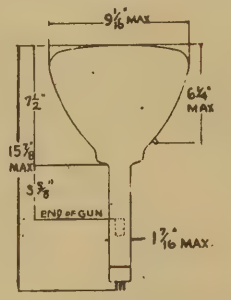
CHARACTERISTICS:			
High Voltage Anode (No. 2)	7000 max.		Volts
Focusing Anode (No. 1)	1900 max.		Volts
Accelerating Grid (No. 2)	250 max.		Volts
Control Grid (No. 1)	Never Positive		
Fluorescent-Screen Input Power Per Sq. Cm.	10 max.		Milliwatts
Fluorescent Color	White		
TYPICAL OPERATION:			
Anode No. 2 Voltage	6000	7000	Volts
Anode No. 1 Voltage approx.	1240	1460	Volts
Accelerating Grid Voltage	250	250	Volts
Control Grid Voltage	Adjust for Suitable Luminous Spot		
Control Grid Voltage for Cut-off	−40 ±50%	−40 ±50%	Volts
Control Grid, Peak-to-Peak Signal Voltage	25	25	Volts
CAPACITANCE:			
Control Grid to all other Elements	12		μμf

9CP4

Short Nine Inch Videotron

INDIRECTLY HEATED CATHODE
HEATER VOLTAGE: 2.5 Volts
HEATER CURRENT: 2.1 Amps.
ELECTROMAGNETIC
DEFLECTION AND FOCUS

PIN No. 1—Heater
PIN No. 2—No Connection
PIN No. 3—Internal Connection
PIN No. 4—Control Grid
PIN No. 5—Cathode
PIN No. 6—Heater
CAP—Anode



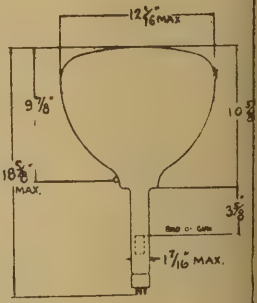
CHARACTERISTICS:			
High-Voltage Anode	7000		Volts
Control Grid Voltage	Never Positive		
Fluorescent Screen Input Power Per Sq. Cm.	10 max.		Milliwatts
Fluorescent Color	White		
TYPICAL OPERATION:			
Anode Voltage	6000	7000 max.	Volts
Control Grid Voltage	Adjust for Suitable Luminous Spot		
Control Grid Voltage for Cut-off	−75 ±50%	−75 ±50%	Volts
Control Grid, Peak-to-Peak Voltage	25	25	Volts
CAPACITANCE:			
Grid to Cathode	12		μμf

12CP4

Short Twelve Inch Videotron

INDIRECTLY HEATED CATHODE
HEATER VOLTAGE: 2.5 Volts
HEATER CURRENT: 2.1 Amps.
ELECTROMAGNETIC DEFLECTION
AND FOCUS

PIN No. 1—Heater
PIN No. 2—No Connection
PIN No. 3—Internal Connection
PIN No. 4—Control Grid
PIN No. 5—Cathode
PIN No. 6—Heater
CAP—Anode



CHARACTERISTICS:			
High-Voltage Anode	7000 max.		Volts
Control Grid Voltage	Never Positive		
Fluorescent Screen Input Power Per Sq. Cm.	10 max.		Milliwatts
Fluorescent Color	White		
TYPICAL OPERATION:			
Anode Voltage	6000	7000	Volts
Control Grid Voltage	Adjust for Suitable Luminous Spot		
Control Grid Voltage for Cut-off	−75 ±50%	−75 ±50%	Volts
Control Grid, Peak-to-Peak Voltage	25	25	Volts
CAPACITANCE:			
Grid to Cathode	12		μμf

(Cont'd)

TYPE 2002

Two Inch Videotron

INDIRECTLY HEATED CATHODE

HEATER VOLTAGE: 6.3 Volts HEATER CURRENT: 0.6 Amps.

ELECTROSTATIC DEFLECTION

High Voltage Anode (No. 2)	600 max.	Volts
Focusing Anode (No. 1)	175 max.	Volts
Control-Grid Voltage	Never Positive	
Cut-off Grid Voltage*	−60 ±30%	Volts
Fluorescent Screen Input Power Per Sq. Cm.	10 max.	Milliwatts
Fluorescent Color	Green	
Overall Length	7-7/16" ± 3/16"	
Maximum Diameter	2-1/16"	
Base	Octal 8 Pin	

TYPICAL OPERATION:

Anode No. 2 Voltage	400	600	Volts
Anode No. 1 Voltage	100	150 approx.	Volts
Grid Voltage	Adjust for Suitable Luminous Spot		
Deflection Sensitivity			
Plates D1 and D2	0.28	0.19	MM/Volt D.C.
Plates D3 and D4	0.33	0.22	MM/Volt D.C.

CAPACITANCE:

Grid-to-all-other-Elements	8.0 max.	μμf

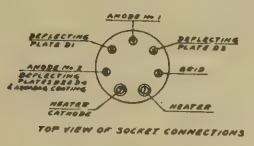
BASING

PIN No. 1—Anode No. 2, Deflecting Plates D2 & D4
PIN No. 2—Heater and Cathode
PIN No. 3—Anode No. 1
PIN No. 4—Deflecting Plate D1
PIN No. 5—Grid
PIN No. 6—Deflecting Plate D3
PIN No. 7—Heater
PIN No. 8—No Connection

2030-2031

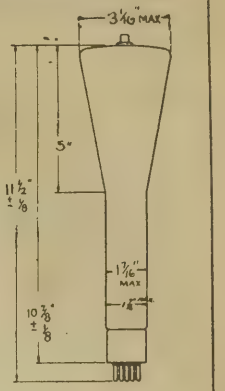
Monotron

INDIRECTLY HEATED CATHODE
HEATER VOLTAGE: 2.5 Volts
HEATER CURRENT: 2.1 Amps.
ELECTROSTATIC DEFLECTION



TOP VIEW OF SOCKET CONNECTIONS

7AN-0-0



CHARACTERISTICS:

High-Voltage Anode (No. 2)	1000 max.	Volts
Focusing Anode (No. 1)	400 max.	Volts
Grid Voltage for Cut-off	−30 ±50%	Volts
Signal-Plate Voltage measured from Anode No. 2	−150 max.	Volts
Signal-Plate Input Power	5 max.	MW/Sq. Cm.
Signal Output (Plate to Plate)	0.01	MA.
Deflection Sensitivity:		
D1 & D2	0.27	MM/Volt D.C.
D3 & D4	0.30	MM/Volt D.C.
Picture Detail	300	Lines

TYPICAL OPERATION:

Anode No. 2 Voltage	900	Volts
Anode No. 1 Voltage	250	Volts
Grid Voltage	Adjust to Give Desired Output	
Signal-Plate Voltage measured from Anode No. 2	−70	Volts

CAPACITANCE:

Grid-to-all-other-Elements	9	μμf

SPECIAL AMPLIFIER AND HALF WAVE RECTIFIER TUBES FOR USE IN CONJUNCTION WITH CATHODE RAY TUBES

LOKTAL AMPLIFIER TUBES

TYPE	DESCRIPTION	FILAMENT VOLTS	FILAMENT AMPS.	PLATE VOLTS	SCREEN VOLTS	CONTROL GRID VOLTS	PLATE CURRENT MA.	SCREEN CURRENT MA.	MUTUAL CONDUCTANCE
7H7	Semi-Remote Cutoff Amplifier	6.3	0.3	250	150	−2.5	9.0	2.5	3500
7V7	R.F., I.F. Pentode	6.3	0.45	300	150	−2.0	9.6	3.9	5800

HIGH VOLTAGE HALF WAVE RECTIFIERS

TYPE	FILAMENT VOLTS	FILAMENT AMPS.	A. C. PLATE VOLTS	PEAK INVERSE VOLTS	PEAK PLATE CURRENT MA.	D. C. OUTPUT MA.	BASE
2V3G	2.5	5.0	6000	16500	12	2	Small shell octal 6-pin
2X2/879	2.5	1.75	4500	12500	100	7.5	Small 4-pin

U. S. NAVY ST'D. TUBE TYPES & THEIR NEAREST COMMERCIAL (RMA) EQUIVALENTS

LISTING BY NEW NAVY TYPE NUMBER

NEW NAVY TYPE NUMBER	COMMERCIAL DESIGNATION (RMA)	OLD NAVY TYPE NUMBER
01-A	01-A	38001
1B4-P	1B4-P	38032-A
1C6	1C6	38236
1D5-G	1D5-G	
1E1	1E1	
1E7-G	1E7-G	38717-E
1F7-G	1F7-G	
1H6-G	1H6-G	
1J6-GX	1J6-GX	
2A3	2A3	38213
2A5	2A5	38215
2B7	2B7	38227
2X2	2X2/879	
4A1	4A1	
5U4-G	5U4-G	
5Z3	5Z3	38593
6A6	6A6	38616
6A7	6A7	38617
6AB7	6AB7/1853	38853
6AC7	6AC7/1852	
6AG7	6AG7	
6B7	6B7	38627
6C5	6C5	
6C5-G	6C5-G	
6C6	6C6	38636
6C8-G	5C8-G	
6D6	6D6	38646
6E5	6E5	38655
6F6	6F6	
6F6-G	6F6-G	
6F7	6F7	38667
6F8-G	6F8-G	38768-F
6H6	6H6	38566-H
6J5	6J5	38565-J
6J5-GT	6J5-GT	(38765-J)
6J7	6J7	
6J7-G	6J7-G	
6K6-GT	6K6-GT	
6K7	6K7	38567-K
6K7-G	6K7-G	
6K8	6K8	38568-K
6L6	6L6	
6L6-G	6L6-G	
6L7	6L7	
6N7	6N7	
6Q7-G	6Q7-G	
6R7	6R7	38567-R
6R7-G	6R7-G	
6SA7	6SA7	
6SF5	6SF5	
6SJ7	6SJ7	
6SK7	6SK7	
6SN7-GT	6SN7-GT	
6SQ7	6SQ7	
6V6-GT	6V6-GT	(6V6-G)
6X5-GT	6X5-GT	
6Y6-G	6Y6-G	38766-Y
6ZY5-G	6ZY5-G	
10	10	38110
12A6	12A6	
12J5-GT	12J5-GT	
12K8	12K8	
12SA7	12SA7	
12SF7	12SF7	
12SJ7	12SJ7	
12SK7	12SK7	
12SQ7	12SQ7	
12SR7	12SR7	
19	19	38019
22	22	38022
24-A	24-A	38024
2525	2525	38255
27	27	38027
30	30	38030
31	31	38031
32	32	38032
33	33	38033
34	34	38034
35	35	38035
36	36	38036
37	37	38037
38	38	38038
39	39	38039
40	40	38040
41	41	38041
42	42	38042
45	45	38045
47	47	38047
50	50	38050
53	53	38053
56	56	38056
57	57	38057
58	58	38058
59	59	38059
71-A	71-A	38071
75	75	38075
76	76	38076
77	77	38077
78	78	38078
80	80	38180
81	81	38181
82	82	38182
83	83	38183
84	84	38184
85	85	38085
89	89	38089
112-A	112-A	38012
203-A	203-A	38103
204-A	204-A	38104
X206	206	38106
207	207	38107
211	211	38211
X214	214	38114
217-C	217-C	38117
X218	218	38118
X219	219	38119
801	801	38101
803	803	38803
805	805	
807	807	38807
808	808	38808
809	809	
812	812	
813	813	
814	814	38814
815	815	
826	826	
829	829	
833-A	833-A	38833
836	836	38266-A
837	837	38837
838	838	38138
842	842	38842
843	843	38143
845	845	38145
846	846	38146
849	849	38149
850	850	38150
851	851	38151
852	852	38152
857-B	857-B	38157-B
858	858	38158
860	860	38160
861	861	38161
862	862	38162
864	864	38064
865	865	38165
866-A	866-A	38166-A
868	868	38268
869-A	869-A	38169-A
870-A	870-A	(38170)
871	871	38171
872-A	872-A	38172-A
874	874	38274
876	876	38276
878	878	
879	(SEE 2X2)	
884	884	38884
886	886	38286
893	893	38193
921	921	
954	954	38954
955	955	38955
956	956	38956
958	958	38958
959	959	38959
1616	1616	38267
1624	1624	
1625	1625	
1626	1626	
1629	1629	
1852	(SEE 6AC7)	
1853	(SEE 6AB7)	
2051	2051	
38015	WE. 215-A	38015
38111-A		38111-A
38112	WE. 212-E	38112
38116	GE 1C9049 / WL S#289416D	38116
X38120	WE. 220-B	38120
38142		38142
38205	RC VR105-30	38205
†X38217	GE. FG-17	30217
38220	AE ZB-120	38220
38222	RP. RK-22	38222
38233	RP. RK-33	38233
38250	RC. VR150-30	38250
38275	RC VR75-30	
38278	HS 1278	38278
38202	WE 282-B	38262
38290	RC VR90-30	
38401	EL 302 5	38401
38402	EL 5B2.5	38402
38403	EL 5B HD	38403
38404	EL 3C	38404
38405	EL 1C	
38412	WE 312-A	38412
†38674	GE 45X674	38674
38674-A	EL 6C	38674-A
†38897	GE 16X897	38897

LISTING BY OLD NAVY TYPE NUMBER

OLD NAVY TYPE NUMBER	NEW NAVY TYPE NUMBER	COMMERCIAL DESIGNATION (RMA)
(6J5-G)	6J5-GT	6J5-GT
(6V6-G)	6V6-GT	6V6-GT
(870)	870-A	870-A
38001	01-A	01-A
38012	112-A	112-A
38015	WE. 215-A	
38019	19	19
38022	22	22
38024	24-A	24-A
38027	27	27
38030	30	30
38031	31	31
38032	32	32
38032-A	1B4-P	1B4-P
38033	33	33
38034	34	34
38035	35	35
38036	36	36
38037	37	37
38038	38	38
38039	39	39
38040	40	40
38041	41	41
38042	42	42
38045	45	45
38047	47	47
38050	50	50
38053	53	53
38056	56	56
38057	57	57
38058	58	58
38059	59	59
38064	864	864
38071	71-A	71-A
38075	75	75
38076	76	76
38077	77	77
38078	78	78
38085	85	85
38089	89	89
38101	801	801
38103	203-A	203-A
38104	204-A	204-A
X38106	206	206
38107	207	207
38110	10	10
38111-A	38111-A	
38112	38112	WE. 212-E
X38114	214	214
38116	38116	WL. S#289416D / GE 189049
38117	217-C	217-C
X38118	218	218
X38119	219	219
X38120	38120	WE. 220-B
38138	838	838
38142	38142	
38143	843	843
38145	845	845
38146	846	846
38149	849	849
38150	850	850
38151	851	851
38152	852	852
38157-B	857-B	857-B
38158	858	858
38160	860	860
38161	861	861
38162	862	862
38165	865	865
38166-A	866-A	866-A
38169-A	869-A	869-A
(38170)	870-A	870-A
38171	871	871
38172-A	872-A	872-A
38180	80	80
38181	81	81
38182	82	82
38183	83	83
38184	84	84
38193	893	893
38205	38205	RC. VR105-30
38211	211	211
38213	2A3	2A3
38215	2A5	2A5
†X38217	38217	GE. FG-17
38220	38220	AE. ZB-120
38222	38222	RP. RK-22
38227	287	287
38233	38233	RP. RK-33
38236	1C6	1C6
38250	38250	RC. VR-150
38255	2525	2525
38266-A	836	836
38267	1616	1616
38268	868	868
38274	874	874
38276	876	876
38278	38278	HS. 1278
38282	38282	WE. 282B
38286	886	886
38401	38401	EL; 302.5
38402	38402	EL; 5B2.5
38403	38403	EL 5B HD
38404	38404	EL 3C
38412	38412	WE. 312-A
38565-J	6J5	6J5
38566-H	6H6	6H6
38567-K	6K7	6K7
38567-R	6R7	6R7
38568-K	6K8	6K8
38593	5Z3	5Z3
38616	6A6	6A6
38617	6A7	6A7
38627	6B7	6B7
38636	6C6	6C6
38646	6D6	6D6
38655	6E5	6E5
38667	6F7	6F7
†38674	38674	GE. 45X674
38674-A	38674-A	EL. 6C
38717-E	1E7-G	1E7-G
(38765-J)	6J5-GT	6J5-GT
38766-Y	6Y6-G	6Y6-G
38768-F	6F8-G	6F8-G
38803	803	803
38807	807	807
38808	808	808
38814	814	814
38833	833-A	833-A
38837	837	837
38842	842	842
38853	6AB7	6AB7/1853
38884	884	884
†38897	3889	GE 16X897
38954	954	954
38955	955	955
38956	956	956
38958	958	958
38959	959	959

NOTES

GENERAL:-

1 THE NAVY VACUUM TUBE SPECIFICATION RE 13A 600 *HAS BEEN ISSUED TO QUALIFIED VACUUM TUBE MANUFACTURERS. EQUIPMENT MANUFACTURERS MAY REVIEW COPIES AT THE VARIOUS INSPECTORS OF NAVAL MATERIAL OR AT THE BUREAU OF SHIPS, NAVY DEPARTMENT, WASHINGTON, D.C*

2. THE PRINCIPLE DIFFERENCE BETWEEN NAVY AND COMMERCIAL VACUUM TUBES IS THAT NAVY SPECIFICATIONS, IN GENERAL, STIPULATE CLOSER TOLERANCES.

3. THE CHARACTERISTICS OF THE VACUUM TUBES LISTED HEREIN MAY BE FOUND IN ANY COMPLETE REPUTABLE VACUUM TUBE HANDBOOK EXCEPT FOR THE SPECIAL TYPES WHOSE COMMERCIAL DESIGNATION IS PRECEDED BY IDENTIFYING LETTERS TO INDICATE THE MANUFACTURER. COMMERCIAL LITERATURE FOR THESE VACUUM TUBES IS AVAILABLE FROM THE RESPECTIVE CONCERNS AS LISTED BELOW.

LIST OF MANUFACTURERS

AE AMPEREX ELECTRONIC PRODUCTS CO.
EL ELECTRONS INC.
EM EITEL McCULLOUGH INC.
GE GENERAL ELECTRIC CO.
HS HYGRADE SYLVANIA CORP.
RC RCA MANUFACTURING CO.
RP RAYTHEON PRODUCTION CORP.
WE. WESTERN ELECTRIC CO.
WL WESTINGHOUSE LAMP CO.

4. ALL VACUUM TUBES EXCEPT THOSE LISTED IN THE TABLE HEADED "VACUUM TUBES FOR USE IN NEW EQUIPMENTS" ARE FOR REPLACEMENT USE ONLY AND ARE NOT TO BE INCORPORATED IN EQUIPMENTS OF NEW DESIGN WITHOUT SPECIFIC APPROVAL OF THE BUREAU OF SHIPS (OR THE GOVERNMENT DEPARTMENT CONCERNED)

5. CATHODE RAY AND UHF TYPES HAVE NOT AS YET BEEN SELECTED FOR THE PREFERRED LIST

6. IT IS INTENDED TO REPLACE THE ACORN TYPES 954, 955 and 956 WITH OTHER TYPES OF AN IMPROVED DESIGN

7 WHERE AN OLD NAVY TYPE NUMBER IS INCLUDED IN PARENTHESES, THE RESPECTIVE LISTINGS COVER THE PROPER REPLACEMENT

FOOTNOTES:-

X TUBE OBSOLETE. NO LONGER MANUFACTURED OR NONE ARE USED IN NAVY EQUIPMENT NOT COVERED BY **RE 13A 600**

† TUBE ALSO COVERED BY NAVY DEPARTMENT SPECIFICATION **17T21** AND DESIGNATED THEREIN AS FOLLOWS

38217 as 0517
38674 as 1674
38897 as 1297

* INDICATES TYPES FOR WHICH NAVY TYPE NUMBER AND SPECIFICATIONS HAVE NOT BEEN ISSUED.

E REVISION JANUARY 15, 1942
D REVISION JANUARY 1, 1942

U. S. ARMY STANDARD TUBE TYPES & THEIR NEAREST COMMERCIAL (RMA) EQUIVALENTS*

Army Type	Equivalent Commercial Type	Army Type	Equivalent Commercial Type	Army Type	Equivalent Commercial Type	Army Type	Equivalent Commercial Type	Army Type	Equivalent Commercial Type	Army Type	Equivalent Commercial Type	Army Type	Equivalent Commercial Type
VT-1	None	VT-39-A	869A	VT-65	6C5	VT-90	6H6	VT-114	5T4	VT-139	VR-150-30	VT-161	12SA7
VT-2	None	VT-40	40	VT-66	6F6	VT-91	6J7	VT-115	6L6	VT-140	R-1628	VT-162	12SJ7
VT-4-B	211	VT-41	851	VT-67	Special 30	VT-91-A	6J7GT	VT-116	6SJ7	VT-141	531	VT-163	6C8G
VT-4-C	None	VT-42-A	872A	VT-68	6B7	VT-92	6Q7	VT-117	6SK7	VT-144	813	VT-164	1619
VT-5	WE215A	VT-43	845	VT-69	6D6	VT-93	6B8	VT-118	832	VT-145	5Z3	VT-165	1624
VT-7	WX-12	VT-44	32	VT-70	6F7	VT-94	6J5	VT-119	879	VT-146	1N5GT	VT-166	371A
VT-17	860	VT-45	45	VT-72	842	VT-94A	6J5G	VT-120	954	VT-148	1D8GT	VT-167	6K8
VT-19	861	VT-46-A	866A, 866	VT-73	843	VT-96	6N7	VT-121	955	VT-149	3A8GT	VT-168	—
VT-22	204A	VT-47	47	VT-74	5Z4	VT-97	5W4	VT-124	1A5GT	VT-150	6SA7	VT-169	1208
VT-24	884	VT-48	41	VT-75	75	VT-98	6U5, 6G5	VT-125	1C5GT	VT-151	6A8G	VT-170	1E5GP
VT-25	10	VT-49	39, 44	VT-76	76	VT-99	6F8G	VT-126	6X5	VT-152	6K6GT	VT-171	1R5
VT-26	22	VT-50	50, 585, 586	VT-77	77	VT-100	807	VT-127	Eimac 100TS	VT-153	12C8 Special	VT-172	1S5
VT-27	30	VT-51	841	VT-78	78	VT-101	837	VT-128	A 5588	VT-154	GL814	VT-173	1T4
VT-28	24A, 24	VT-52	45-Special	VT-80	80	VT-103	6SQ7	VT-129	304TL			VT-174	3S4
VT-29	27	VT-54	34	VT-83	83	VT-104	12SQ7	VT-130	250TL	VT-155	Reserved for Special Types	VT-175	1613
VT-30	01A, 01	VT-55	865	VT-84	84, 98, 6Z4	VT-105	6SC7	VT-131	12SK7	VT-156		VT-177	1LH4
VT-31	31	VT-56	56	VT-86	6K7	VT-106	803	VT-132	12K8	VT-157		VT-178	1LC6
VT-33	33	VT-57	57	VT-86A	6K7G	VT-107A	6V6GT	VT-133	12SR7	VT-158		VT-179	1LN5
VT-34	207	VT-58	58	VT-87	6L7	VT-107	6V6	VT-134	12A6	VT-159		VT-180	3LE4
VT-35	35, 51	VT-60	850	VT-87A	6L7G	VT-108	Eimac 450th	VT-135	12J5GT	VT-160		VT-181	7Z4
VT-36	36A, 36	VT-62	801	VT-88	6R7	VT-109	2051	VT-136	1625			VT-182	1291
VT-37	37, 37A	VT-63	46	VT-88A	6R7G	VT-111	5BP4	VT-137	1626			VT-183	1294
VT-38	38, 38A	VT-64	800	VT-89	89	VT-112	6AC7	VT-138	1629				

**Reprinted by Courtesy the Engineering Dept. National Union Radio Corp.*

U. S. ARMY-NAVY PREFERRED TUBE TYPES TO BE USED IN NEW EQUIPMENT†

HE accompanying Army-Navy Preferred List of Vacuum tubes sets up a group of unclassified general purpose tubes selected jointly by the Signal Corps and the Bureau of Ships. The purpose of this list is to effect an eventual reduction in the variety of tubes used in Military Service equipment. The functional service performed by the much larger number of tube types previously employed (see charts in *Sect. 27* and *Sect. 28*) can be met by these fewer "preferred" types.

It is mandatory that all unclassified tubes to be used in all future designs of *new* equipment under the jurisdiction of the Signal Corps Laboratories or the Radio and and Sound Branch of the Bureau of Ships be chosen from this list unless it can be demonstrated to the Government department concerned that these types do not adequately serve the purpose.

RECEIVING TUBES

Filament Volts	Diodes	Diode Triodes	Triodes	Twin Triodes	Pentodes		Rectifiers	Converters	Power	Indicators
					Remote	Sharp				
1.4	1A3	1LH4	1G4GT 957 958A	1291 3A5	1T4	1S5 959 1LN5 1L4		1LC6 1R5	3A4 1299 3Q4 3Q5GT	991
5.0							5U4G 5Y3-GT			
6.3	6H6* 9004	6SQ7* 6SR7*	6J5* 1201 955 7193 9002	6SL7GT 6SN7GT	6SG7* 6SK7* 956 9003	6AC7* 6AG7* 6SH7* 6SJ7* 717-A 954 9001	6X5-GT 1005	6SA7*	6L6-G 6V6-GT 6N7-GT 6B4-G 6Q6-G 6Y6-G	6E5
12.6	12H6*	12SQ7* 12SR7*	12J5-GT	12SL7-GT 12SN7-GT	12SG7* 12SK7*	12SH7* 12SJ7*		12SA7*	12A6	1629

TRANSMITTING TUBES

MISCELLANEOUS TUBES

Triodes	Tetrodes	Twin Tetrodes	Pentodes	Rectifiers		Grid Cont. Gas Rectifiers	Voltage Regulators	Phototubes
				Vacuum	Gas			
801-A 811 826 833-A 838 1626 8005 8025 304TH	807 813 814 1625	815 829 832	803 837 2E22	2X2 836 1616 8020 (451) 705A 371A	83 866A 872A 4B25	2050 884 394-A C1B C5B	VR-90-30 VR-105-30 (38205) VR-150-30 (38250)	918 927

* Where interchangeability is assured GT counterparts of the preferred metal tubes may be used.
September 28, 1942

†**Note:** *These lists do not include Cathode Ray Tubes, or certain tubes used in equipment classified as "secret," or very special tubes for employment at ultra-high frequencies (250 megacycles and upward). The status of such tubes will be made the basis of separate consideration by the Bureau.*

MODERNIZING OLD RECEIVERS BY SUBSTITUTING NEWER IMPROVED TYPES OF TUBES FOR OLDER & OBSOLETE TYPES

SERVICE MEN can perform a worth-while service to many of their customers, and at the same time boost their tube sales, by substituting new types of tubes for many of the older or now-obsolete types originally used in old receivers. Of course, this practice is only recommended in cases where the owner of such an old, obsolete receiver cannot afford to purchase a new one.

Such tube substitution cannot be done in a haphazard, slap-dash way, nor can it be done with all types, but there are numerous newer tube types that can be used *directly* to replace many old tube types with little or no trouble—that is, without the necessity for completely modernizing the receiver circuits, changing sockets or wiring, etc. Examination of the extreme right-hand column in the *Receiving Tube Characteristics Chart of Section 22,* and the chart in *Section 23,* will reveal the correct "replacement" or "substitution" tubes to use in any case.

Some Replacements Which Improve Receiver Performance

For example, there are the obsolete tubes such as the 00, 01, and 01B which can be replaced by the type 01A tube. The type 1 and the KR1 can be replaced with the 1V tube, the KR5 tube with the 6A4, etc.

Then the type 27 tube may be *directly* replaced with the type 56, and the type 37 tube directly replaced with the type 76 tube. In most cases, such a replacement *and a re-alignment* of the tuning circuits associated with the replacement tube will give added "pep" to an old set. If oscillation or instability, due to the increased gain) results after a careful re-alignment (and neutralization if necessary) is carried out, it may be necessary to replace less than all of these types in any given set.

Another direct replacement which results in improved receiver performance is that of a type 42 for a type 41 output tube in auto-radio receivers. The change usually results in a higher output, and the only difference in operating characteristics between the two tubes is the higher filament current drain of the type 42. Both the 41 and the 42 can be also replaced with the type 6B5. However, in this case it is necessary to *ground the cathode terminal* as the 6B5 requires no cathode bias for anode voltages under 325 volts. If the cathode circuit is found to be already grounded, the grid-return circuit should be removed where it is connected to the low side of the power supply and re-connected to ground.

Replacing "GT" Tubes by Equivalent "Metal" Tubes

Metal tubes, in almost all cases, may be used to replace *equivalent* "GT" types when desired, or vice versa.

It may be found necessary to re-align the tuning of the r-f circuits in which such a tube "swap" has been made, due to the slight differences in inter-electrode capacities of the two groups of tubes. However, such capacity differences are usually quite small and may result in no appreciable change of frequency in the tuned circuits.

As the metal tubes are approximately the same physical size as the equivalent "GT" types, no space problem is involved in the substitution. The performance and average life of the two types should also be equally satisfactory.

Replacement of Metal, M, MG, G, and GT Tubes

In like manner equivalent types of metal, M, MG, G, GT, etc. tubes are *usually* interchangeable, but the use of unshielded tubes may require the installation of external shields and, of course, a difference in tube inter-electrode capacitances usually necessitates a re-alignment of the tuned circuits.

However, any receiver can usually be made to perform better by a re-alignment after such tube substitutions.

Summary of Interchangeability Conditions

As summarized by the *Raytheon Production Corp.,* in general certain tube types can be used as replacements for other tube types under the following conditions:

(*A*) Tube types having the same RMA type numbers (with a letter, or two letters, between two numbers, as 6A7 or 6ZY5G) are interchangeable.

(*B*) On standard tube types with two or three figure type numbers, the last two figures form the significant type numbers regardless of letter prefixes. For example, the 45 tube will replace the UX-245, CX-345, or SX-245 tubes.

(*C*) Types differeing in number by the suffix letter "A", "G", "H", "MG" or "V" are interchangeable in general regardless of this letter. For example, the 12A may replace a 112 or 112A, the 2A3 may replace a 2A3H, and a 6A8G may replace a 6A8 or 6A8MG.

(*D*) Tube with octal bases and standard size glass bulbs are designated by the suffix, "G" on the type number, as 6A8G. Tubes with octal bases, glass bulbs and attached metal shields are designated by the suffix "MG" on the type number, as 6A8MG. Tubes with octal bases and metal bulbs have no suffix on the type number, as 6A8. "G" type tubes having type numbers corresponding to metal tube or "MG" type numbers have, in general the same electrical characteristics excepting capacitances, and are usually interchangeable with the corresponding metal or "MG" types except for space requirements and the possible requirement of external tube shields.

(*E*) Shielded types distinguished by the added suffix letter "S" may, or may not, be interchangeable with types which do not have this letter suffix.

(*F*) Exceptions to the above tubes are types, D-1, DE-1, RE-1, SO-1, RE-2, SO-2, KR-20, KR-22, KR-28, 43MG, HZ-50, 59B, G-84, 182B, 183, Kellogg 401, 482A, 482B, 484, 484A, and 25Z5MG, which do not correspond with types 1-V, 20, 22, etc. The 01A (201A) is not interchangeable with the 1-V, or 1, and the WX-12 is not interchangeable with the 12A (112A). Types 57AS, 58AS, 485 and 950 may be replaced only by tubes bearing the same full type number.

Using Multiple-etched Type Tubes for Replacements

Several prominent tube manufacturers are putting into effect a program designed to cut down the large number of different tube types now in use by eliminating certain groups of tube types which are replaceable by comparable equivalent single tubes (where there would be no trouble encountered with interchangeability). Multiple-etched type numbers

("GT/G" tubes) are assigned to the single *equivalent* tubes in such cases.

In some instances, the multiple-etched type is equivalent to only *two* other tube types. The multiple-etched tube 1A5GT/G, which can be used as a direct replacement for either a 1A5G, or a 1A5GT tube, is an example of this. In other instances, the multiple-etched type can be used to replace *three* corresponding types—the Metal, the "G" and also the "GT" style. The "Sylvania" multiple-etched tube 6X5GT/G, which can be used as a direct replacement for either a 6X5 metal tube, a 6X5G, or a 6X5GT, is an example of this. The physical size of the GT/G tube is the same as that of the original equivalent GT type, and the electrical characteristics have been standardized by the RMA so that complete interchangeability is possible.

The advantages of becoming acquainted with the multiple-etched tube types offered by each tube manufacturer, and of becoming accustomed to their use as replacements are apparent. First, the service man's tube stock turn-over will be improved, since only one multiple-etched type will be required to replace the two or three types it is equivalent to, as the case may be. The use of these multiple-etched types also simplifies the service problem by making it necessary to have only one type available for a service job where it was previously necessary to have two or three types on hand.

To assist in this work, a chart of the "Sylvania" multiple-etched tubes and the older tube types they may be used to replace directly is given below. Any exception to their direct interchangeability is shown in the column headed, *"REMARKS."* The service man should study this chart. Similar information will also be found in the *Tube Charts Sections 22* and *23*.

CHART OF SYLVANIA MULTIPLE-ETCHED TYPE REPLACEMENT TUBES

Type	REPLACE WITH SYLVANIA TYPE	Remarks
OZ4G	**0Z4**	Type OZ4 may be used as a direct replacement.
1A5G 1A5GT	**1A5GT/G**	Type 1A5GT/G may be used as a direct replacement.
1C5G 1C5GT	**1C5GT/G**	Type 1C5GT/G may be used as a direct replacement.
1G4G 1G4GT	**1G4GT/G**	Type 1G4GT/G may be used as a direct replacement.
1G6G 1G6GT	**1G6GT/G**	Type 1G6GT/G may be used as a direct replacement.
1Q5G 1Q5GT	**1Q5GT/G**	Type 1Q5GT/G may be used as a direct replacement.
3Q5G 3Q5GT	**3Q5GT/G**	Type 3Q5GT/G may be used as a direct replacement.
5T4	**5U4G**	Type 5U4G may be used for replacement where space permits and power transformer will stand one ampere additional current.
5W4 5W4G 5W4GT/G	**5W4GT/G**	Type 5W4GT/G may be used as a direct replacement.
5Z4	**5Y3G**	Type 5Y3G will replace, except where space does not permit.
6A8	**6A8GT**	Type 6A8GT may be used. An external shield and realignment may be necessary.
6AC5G 6AC5GT	**6AC5GT/G**	Type 6AC5GT/G may be used as a direct replacement.
6B6G	**6Q7G**	Type 6Q7G may be used as a direct replacement.
6B8	**6B8G**	Type 6B8G may be used, except where space does not permit. An external shield and realignment may be necessary.
6C5 6C5G 6C5GT	**6C5GT/G**	Type 6C5GT/G will replace. In some cases an external shield and realignment may be necessary.
6C6	**77**	Type 77 will replace in most cases.
6D6	**78**	Type 78 will replace in most cases.
6F5	**6F5GT**	Type 6F5GT will replace. In some cases an external shield and realignment may be necessary.
6F6	**6F6G**	Type 6F6G may be used, except where space does not permit or where coupling between tubes is a problem.
6H6 6H6G 6H6GT	**6H6GT/G**	Type 6H6GT/G may be used as a direct replacement.
6J5 6J5G 6J5GT/G	**6J5GT/G**	Type 6J5GT/G may be used as a direct replacement.
6J7	**6J7GT**	Type 6J7GT may be used. An external shield and realignment may be necessary.
6K6G 6K6GT	**6K6GT/G**	Type 6K6GT/G may be used as a direct replacement.
6K7	**6K7GT**	Type 6K7GT may be used. An external shield and realignment may be necessary.
6K8	**6K8GT**	Type 6K8GT may be used. An external shield and realignment may be necessary.
6L6	**6L6G**	Type 6L6G may be used, except where space does not permit or where coupling between tubes is a problem.
6L7	**6L7G**	Type 6L7G may be used, except where space does not permit. An external shield and realignment may be necessary.
6N7	**6N7G**	Type 6N7G may be used, except where space does not permit. An external shield and realignment may be necessary.
6P5G 6P5GT	**6P5GT/G**	Type 6P5GT/G may be used as a direct replacement.
6Q7	**6Q7GT**	Type 6Q7GT may be used. An external shield and realignment may be necessary.
6R7	**6R7GT**	Type 6R7GT may be used. An external shield and realignment may be necessary.
6S7	**6S7G**	Type 6S7G may be used, except where space does not permit. An external shield and realignment may be necessary.
6SA7	**6SA7GT/G**	Type 6SA7GT/G will replace. In a few cases an external shield and realignment may be required.
6SA7GT	**6SA7GT/G**	Type 6SA7GT/G may be used as a direct replacement.
6SF5	**6SF5GT**	Type 6SF5GT may be used. An external shield and realignment may be necessary.
6SJ7	**6SJ7GT**	Type 6SJ7GT may be used. An external shield and realignment may be necessary.
6SK7	**6SK7GT/G**	Type 6SK7GT/G will replace. In a few cases an external shield and realignment may be necessary.
6SK7GT	**6SK7GT/G**	Type 6SK7GT/G may be used as a direct replacement.
6SQ7	**6SQ7GT/G**	Type 6SQ7GT/G will replace. In a few cases an external shield and realignment may be necessary.
6SQ7GT	**6SQ7GT/G**	Type 6SQ7GT/G may be used as a direct replacement.
6V6 6V6G 6V6GT	**6V6GT/G**	Type 6V6GT/G may be used as a direct replacement.
6W5G	**6X5GT/G**	Type 6X5GT/G may be used where output current drain is not greater than 70 ma.
6X5 6X5G 6X5GT	**6X5GT/G**	Type 6X5GT/G may be used as a direct replacement.
7A7LM	**7A7**	Type 7A7 is preferable.
7B5LT	**7B5**	Type 7B5 is preferable.
7B6LM	**7B6**	Type 7B6 is preferable.
7B8LM	**7B8**	Type 7B8 is preferable.
7C5LT	**7C5**	Type 7C5 is preferable.
12B7	**14A7/12B7**	Type 14A7/12B7 may be used as a direct replacement.
12K8	**12K8GT**	Type 12K8GT will replace. In a few cases an external shield may be necessary.
12SA7	**12SA7GT/G**	Type 12SA7GT/G will replace. In a few cases an external shield and realignment may be necessary.
12SA7GT	**12SA7GT/G**	Type 12SA7GT/G may be used as a direct replacement.
12SF5	**12SF5GT**	Type 12SF5GT will replace. In some cases an external shield and realignment may be necessary.
12SJ7	**12SJ7GT**	Type 12SJ7GT will replace. An external shield and realignment may be necessary.
12SK7	**12SK7GT/G**	Type 12SK7GT/G will replace. In a few cases an external shield and realignment may be necessary.
12SK7GT	**12SK7GT/G**	Type 12SK7GT/G may be used as a direct replacement.
12SQ7	**12SQ7GT/G**	Type 12SQ7GT/G will replace. In a few cases an external shield and realignment may be necessary.
12SQ7GT	**12SQ7GT/G**	Type 12SQ7GT/G may be used as a direct replacement.
25A6 25A6G 25A6GT	**25A6GT/G**	Type 25A6GT/G may be used as a direct replacement.
25A7G 25A7GT	**25A7GT/G**	Type 25A7GT/G may be used as a direct replacement.
25AC5G 25AC5GT	**25AC5GT/G**	Type 25AC5GT/G may be used as a direct replacement.
25L6 25L6G 25L6GT	**25L6GT/G**	Type 25L6GT/G may be used as a direct replacement.
25Z6 25Z6G 25Z6GT	**25Z6GT/G**	Type 25Z6GT/G may be used as a direct replacement.
35A5LT	**35A5**	Type 35A5 is preferable.
35L6G 35L6GT	**35L6GT/G**	Type 35L6GT/G may be used as a direct replacement.
35Z3LT	**35Z3**	Type 35Z3 is preferable.
35Z5G 35Z5G	**35Z5GT/G**	Type 35Z5GT/G may be used as a direct replacement.
50Y6G 50Y6GT	**50Y6GT/G**	Type 50Y6GT/G may be used as a direct replacement.
117L7GT 117M7GT	**117L7/M7GT**	Type 117L7/M7GT may be used as a direct replacement.
117Z6G 117Z6GT	**117Z6GT/G**	Type 117Z6GT/G may be used as a direct replacement.

TUBE TESTERS — IMPORTANT THINGS ABOUT THEIR SELECTION & OPERATION

AN efficient tube tester is a prime essential in any radio service shop—regardless of the variety and types of all other test equipment the service man may possess. Whether the service man purchases a tube tester which is large or small, portable or bench-mounted, emission or other type, of one make or another, depends upon too many factors to make it possible to lay down definite, hard-and-fast rules here.

The main consideration which takes prime preference over all others is the *testing ability* of the equipment, i.e., the accuracy with which it will classify a satisfactory tube as *GOOD* and an unsatisfactory tube as *BAD*.

Limitations of Commercial Tube Testers

It is a well known fact that, except by very careful and intricate tests made with expensive laboratory equipment, the tube manufacturer himself, often cannot classify a bad tube from a good tube. Even these elaborate tests are not completely conclusive in the case of tubes used for certain purposes in certain receivers, and thus a measure of tolerance must be exercised by the radio service man toward his particular commercial tube tester which has cost him but a fraction of the price of a laboratory model.

It is also a well known axiom that "you get what you pay for" and this applies to tube testers as well as to other things in life. A $10 tube tester is worth $10—a $50 tube tester is worth $50—and the chances are 99 in 100 that the more expensive tester will check tubes a great deal more accurately than the cheaper unit.

Money-Making Possibilities of an Accurate Tube Tester

Many service men who really should know better do not realize the money-making possibilities of an *accurate* tube tester over the *money-losing* certainties of a cheap, inferior tube tester. Let us take, as an example, two tube testers of different makes, one selling for $10 and the other for $50. If the $10 tester fails to show, as BAD, two out of five *bad* tubes, *the potential tube sales of the serviceman-owner is thereby reduced by 40%!* Let us assume that, with a more accurate tube tester, he could sell $50 in tubes per month—a not unlikely figure. By the continued use of his $10 tester, he would lose *$20 worth of tube sales per month!* In other words, after four months of use, he would lose the difference in price between the two tube testers, *and from then on his inferior tube tester would be a money loser* instead of a *money maker!* (Four months would be required, assuming a 50% gross profit on tubes.)

Important Considerations in the Purchase of a Tube Tester

It is not intended here to arbitrarily convey the idea that the more expensive a tube tester is, the more accurate it necessarily will be. However, the test instrument industry has become so competitive that tube tester original cost bears a very certain relation to tube tester accuracy, as has been proved in laboratory tests. Accuracy percentages as low as 20% and as high as 96% have been recorded between tube testers of varying makes and price levels.

(1) Therefore, when you buy your next tube tester buy *up* as far in price as you can afford in order to assure yourself of maximum accuracy.

(2) Another important consideration in the purchase of a tube tester is the past record, experience and present standing among *other* service men of the tube tester manufacturer. "Ask the man who owns one" is another axiom which it would be wise for the service man to follow.

(3) Another consideration is the *number of tubes* the tube tester can check at the present time, and the *obsolescence-proof features,* if any, that are justly claimed for it by the tester manufacturer. These factors should weigh heavily in the balance of one tube tester against another.

(4) A further consideration is *speed of operation* of the tube tester. The use of "roll" charts, simplified grouping of controls, and multi-deck switches have speeded up tube testing considerably. However, do not assume that because one tube tester has *two* controls and another has *six* controls, that the first tester is necessarily the better one. To accomplish the reduction in controls, certain compromises most likely were made, and it would be wise to check the accuracy of the two units in testing doubtful tubes to ascertain whether such compromises were harmful.

(5) Another consideration, and a very important one, is whether adequate provision has been made to check the leakage of *every element* with respect to *every*

other element—not merely with respect to the cathode or filament. The test should be made at recommended RMA leakage resistance values.

(6) The final consideration is the matter of the tube tester circuit, i e., whether an "emission", "mutual conductance", "dynamic", etc., circuit is used. It is not within the province of this book to enter into a discussion of the relative merits of one circuit as compared to another. It must be stressed, however, that *all "emission" circuits are not equally accurate or equally inaccurate* as appears to be the popular conception. If a tube is tested by the emission method, and is tested under correct voltage and load conditions, the result of the test will attain a high order of accuracy as is attested by the Radio Manufacturers Association. The emission test has a distinct advantage over other circuits in that it requires a minimum number of controls for maximum accuracy. Many so-called "Mutual Conductance" tube testers are no better than grid-shift tube testers in that they are not designed to comply with correct requirements for a true mutual conductance test.

How to Operate a Tube Tester Correctly

And now a word about tube tester operation. When you buy your next tube tester, *study the operating data thoroughly*. Do *not* operate the tester contrary to the accompanying instructions. Do *not* hold the tube tester under test any longer than it takes to ascertain its reading. Make *all* the tests available on *every* tube—including *short* and *inter-element leakage* tests. Make an *open-element* test, if available, on all tubes removed from sets which are "dead" (completely inoperative). Do *not* expect to reliably check the oscillating abilities of a tube containing an oscillator section, or a tube used as a separate oscillator. Such a test is *impossible* on any checker ever devised, as the same tube may oscillate in one receiver and not in another.

Use Tube Tester in Receiver Trouble Analysis

Use your tube tester as a primary means of analyzing the trouble in each receiver. ALWAYS TEST ALL TUBES IN ALL RECEIVERS. That's the way to boost your tube sales and the way to make greater service profits.

Buy the *best* tube tester, use it to the *best* of your ability and obtain the *best* results in increased tube sales.

INTERPRETATION OF RMA RECEIVING TUBE RATINGS

TUBE manuals and charts show the tube ratings based on the new system of rating receiving tubes recently adopted by the RMA and now followed by tube manufacturers. This new method relates to basic standards as regards tube electrode voltages, supply voltages, etc. A complete understanding of these basic standards should prove helpful to the radio service man in understanding tube ratings.

It used to be common practice for tube manufacturers to rate all tubes at their maximum operating voltages, but receiver designers usually made their calculations on the basis that the maximum operating voltages would be obtained at an average line voltage of 117 volts or less, in the case of ac line-operated receivers. However, since the line voltage varies in different locations (and even at different times of the day and night for the same location), receivers often operate at voltages *above* and/or *below* that for which their design calculations were made. When they operate *above,* the tube life is shortened. Of course many tubes are designed with a factor of safety so that their maximum rated voltages may be slightly exceeded without serious decrease in useful life, but many are not so designed.

In order to standardize all these ratings, all tubes are now to be rated according to the *"design maximum,"* rather than to the *"absolute maximum"* as heretofore. As applied to the voltages at the various tube electrodes, and the types of service, the following conditions will be observed.

Heater Voltage and Cathode Ratings

The heater or filament voltage is given as a "normal" value unless otherwise stated. This means that transformers or resistances in the heater or filament circuit should be designed to operate the heater or filament at full rated voltage for full-load operating conditions under average supply-voltage conditions. A reasonable amount of leeway is incorporated in the cathode design so that moderate fluctuations of heater or filament voltage *downward* will not cause marked falling off in response; also, moderate voltage fluctuations *upward* above the design maximum will not reduce the life of the cathode to an unsatisfactory degree.

(1) 1.4 Volt Battery Tube Types: The filament power supply may be obtained from dry-cell batteries, from storage batteries, or from a power line.

Dry Battery Operation:

The 1.4 volt line of battery tubes is designed to be operated from a dry cell rated at a terminal potential of 1.5 volts. The filament may be connected either directly across a dry cell rated at a terminal potential of 1.5 volts, or in series with the filaments of similar tubes across a power supply consisting of a suitable number of dry cells in series. In either case, the voltage across each 1.4 volt section of filament should not exceed 1.6 volts. In the case of series operation, suitable shunting resistors may be required to obtain this condition.

Operation from other Power Sources:

When the power line or a storage battery is used for power supply, the filament may be operated in series with the filaments of similar tubes. For such operation, design adjustments should be made so that, with tubes of rated characteristics (operating with all electrode voltages applied and on a normal line voltage of 117 volts, or on a normal storage-battery voltage of 2.0 volts per cell without a charger, or 2.2 volts per cell with a charger), the voltage drop across each 1.4 volt section of filament will be maintained within a range of 1.25 to 1.4 volts (with a nominal value of 1.3 volts). In the case of series operation, suitable shunting resistors may be required to obtain this condition.

(2) 2.0 Volt Battery Tube Types: The 2.0 volt line of tubes is designed to be operated with 2.0 volts across the filament. In all cases the operating voltage range should be maintained within the limits of 1.8 volts to 2.2 volts.

Voltage Ratings of Plate and Screen

In the case of plate voltage and screen voltage, howeevr, recommended *maximum* values are specified. The interpretation of this maximum value depends on the nature of the power source, as follows:

(1) AC or DC Power Line Operation:

The maximum ratings of plate and screen voltages and dissipations given on the tube characteristic charts (*Sect. 22*) are *Design Maximums.* For equipment designed for use in the United States on nominal power line services of 105 to 125 volts, satisfactory tube performance and serviceability may be anticipated, provided the equipment is designed so as not to exceed these *Design Maximums* at a line voltage of 117 volts.

(2) *Automobile Storage Battery Operation*:

When a tube is used in automobile receivers and other equipment operated from automobile storage batteries, consideration should be given to the larger percentage range over which the battery voltage varies as compared with the power-line voltage. The average voltage value of automobile batteries has been established as 6.6 volts. Automobile battery operated equipment should be designed so that when the battery voltage is 6.6 volts, the plate voltage, the plate dissipation, the screen voltage, the screen dissipation, and the rectifier load current will not exceed 90% of the respective recommended *Design Maximum* values given in the data for each tube type.

(3) *Battery Operation*:

Equipment operated from "B" batteries should be designed so that under no condition of battery voltage will the plate voltage, the plate dissipation, the screen voltage, and the screen dissipation ever exceed the recommended respective maximum values shown in the data for each type by more than 10%.

Voltage Ratings of Other Positive Electrodes

When a tube is of the multigrid type, the voltages applied to the additional positive electrodes will be governed by the considerations stated under Plate and Screen.

Typical Operation

For many receiving tubes, the data show typical operating conditions in particular services. These typical operating values are given to show concisely some guiding information for the use of each type. They are not to be considered as ratings, because the tube can be used in any circuit or under any suitable operating conditions provided its rating limitations are not exceeded.

PILOT LAMP AND DIAL LAMP DATA & RMA IDENTIFICATION COLOR CODE CHART*

THE multiplicity of uses to which miniature dial lamp bulbs are put in modern radio receivers has made the design of several specific types necessary.

The early types of miniature lamps were used primarily as on-or-off indicators in radio receivers. Then they were used to illuminate the translucent type of tuning dial. In our present complicated radio equipment, they are employed for a multiplicity of purposes, such as for illumination of translucent tuning dials and volume-control scales, waveband indicator lights, in remote-control heads, as pilot lights, in tuning meters, in various flash-tuning arrangements, etc. Consequently, a number of types of such lamps having various desirable filament designs, bulb sizes and shapes, base designs, voltage ratings, etc., have been developed to meet the requirements of all these varied applications. Service men must familiarize themselves with all of them, and must be able to readily identify the exact type number of any faulty lamp which must be replaced.

Lamp Operating Voltages and Circuit Arrangements

As will be seen from the *Design Volts* column in the accompanying *Lamp Characteristic Chart*, different lamps are designed for operation at different filament voltages. These range all the way from 2 volts to 7.5 volts.

Of course, this is necessary because of the various circuit arrangements employed in obtaining the dial lamp voltage supply and the various voltages which may be available in different types of receivers. Where the dial lamps are merely connected in parallel across a 2.0, 2.5, 5.0, or 6.3 volt filament circuit in a-c receivers, the arrangement is simple. In some of the earliest ac-dc receivers, dial lamps rated at 2.5-volts 0.5-amperes were connected in series with the 0.3-ampere tube heaters. However, the fact that the dial light was being operated with a sub-normal filament current caused the illumination to be meagre, and because of the straight series arrangement, failure of the dial light filament resulted in an inoperative receiver. These objectionable operating features have made this arrangement obsolete.

In present-day ac-dc receivers No. 40, 44, 46 or 47 type dial lamps are commonly employed, the necessary filament voltage being developed across a suitable resistor connected in series with the tube filaments and in shunt with the dial lamp. In case of lamp failure, the heater circuit does not open. In order to prevent initial surge voltage (due to the fact that the initial starting current is considerable greater than the normal operating current because the *cold* resistance of the tube heaters is considerably *lower* than the resistance at operating temperatures) some receivers employ special ac-dc ballast tubes in which the original or *cold* value of the pilot light shunt resistor is low enough to protect the lamp, and whose final or *hot* value is high enough to provide the proper operating voltage with its accompanying high illumination. These resistors employ the heat generated in the main resistor for their operation.

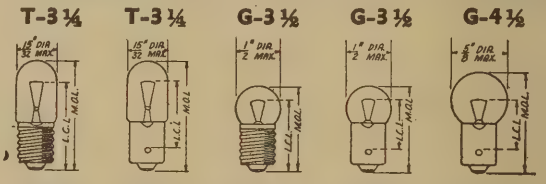
Filament Shapes and Requirements

There are several distinct shapes or forms of filaments used in these lamps. In tuning meters of the shadow-producing types, where it is necessary for maximum contrast to have the edges of the vane sharply delineated, the filament of the lamp must be of straight-line form so that the images reflected from the bulb walls will not pass through the aperture and act as secondary sources of light. This straight horizontal coil filament is known as the *C-6* form.

The *arched* form of coil filament (mounted bow-shaped between the two copper lead wires) which was used in

(Cont'd)

Various Bulb Shapes and Base Types—and Dimensions



Used in Mazda Lamp No.	*Used in Mazda Lamp No.*	*Used in Mazda Lamp No.*	*Used in Mazda Lamp No.*	*Used in Mazda Lamp No.*
40	40A	50	51	55
41	43			
42	44			
46	45			
48	47			
292	49			
	49A			
	292A			

FIG. 33-1.—Various bulb and base combinations employed in pilot lamps and dial lamps. Reading from left to right we have: tubular bulb with screw type base, tubular bulb with bayonet base, small globular bulb with screw base, small globular bulb with bayonet base, and large globular bulb with bayonet base. The type numbers of the lamps each combination is used in are listed directly below each illustration.

*Compiled and arranged from data furnished through the *courtesy* of *Service Magazine*, the *General Electric Co.*, the *Westinghouse Lamp Co.*, the *Raytheon Production Corp.*, and *Sylvania Electric Products Inc.*

the early panel lamps is the *C-2* type. This shape has the advantage of casting light all around the lead wires so as to prevent any sharp shadows of the leads from being cast on the illuminated dial. This shape of filament is only useful mainly for dial illumination but it is still used in certain types of lamps.

In the special forms of lamps used in battery-operated receivers, where the available operating voltage is low and the current is of the order of only 60 ma., a straight-wire filament form known as the *S-2* is used, because the filament employed must be so short that coiling cannot be resorted to.

The filaments of present-day lamps must be constructed to withstand the loud-speaker vibrations, provide noise-free operation, have current drains within the required limits (particularly when used in ac-dc receivers and battery-operated receivers), and provide shadowless illumination.

Bulb Shapes

Early types of dial lamps employed a tubular shaped bulb to distinguish them from the flashlight and automotive types. Th s tubular shape (which measures approximately 3¼ eights of an inch) is known as the type *T-3-¼*. Although other forms of bulbs have been considered, the *T-3-¼* shape of bulb is still employed for dial lamps of most home receivers.

In auto-radio receivers, because of the restricted space available in the remote-control tuning heads, the globular *"G"* type of bulb is more popular. This is made in two sizes. The tubular, and both sizes of globular bulbs are illustrated in Fig. 33-1.

PILOT AND DIAL LAMP DATA & RMA IDENTIFICATION COLOR CODE CHART*

Bead Color	Type of Base (Miniature)	Bulb Type	Lamp Type No.	Circuit Volts	Design Volts	Amperes At Design Volts	Average Hrs. Life At Design Volts	Approx. Candle-Power	Type of Service	Remarks	L.O.L. (Inches)	M.O.L. (Inches)	Lamp No.
Brown	Screw	T-3¼	40	6-8	6.3	0.15	3000	0.5	Dials		29/32	1⅛	40
Brown	Bayonet	T-3¼	40-A**	6-8	6.3	0.15	3000	0.5	Dials	Interchangeable with No. 47	23/32	1⅛	40-A
White	Screw	T-3¼	41	2.5	2.5	0.5	3000	0.5	Dials		29/32	1⅛	41
Green	Screw	T-3¼	42	3.2	3.2	*	1000	0.75	Dials		29/32	1⅛	42
White	Bayonet	T-3¼	43	2.5	2.5	0.5	3000	0.5	Dials and Tuning Meters		23/32	1⅛	43
Blue	Bayonet	T-3¼	44	6-8	6.3	0.25	3000	0.8	Dials and Tuning Meters		23/32	1⅛	44
†	Bayonet	T-3¼	45	3.2	3.2	*	3000	0.75	Dials		23/32	1⅛	45
Blue	Screw	T-3¼	46	6-8	6.3	0.25	3000	0.8	Dials and Tuning Meters		29/32	1⅛	46
Brown	Bayonet	T-3¼	47**	6-9	6.3	0.15	3000	0.5	Dials	Interchangeable with No. 40-A	—	1⅛	47
Pink	Screw	T-3¼	48	2.0	2.0	0.06	1000	—	Dials	Battery Set Dials	29/32	1⅛	48
Pink	Bayonet	T-3¼	49**	2.0	2.0	0.06	1000	—	Dials	Battery Set Dials	23/32	1⅛	49
White	Screw	T-3¼	----	2.1	2.1	0.12	—	—	Dials	Replace with No. 48	—	—	----
White	Bayonet	T-3¼	49-A**	2.1	2.1	0.12	—	—	Dials	Replace with No. 49	23/32	1⅛	49-A
White	Screw	G-3½	50	6-8	7.5	0.2	1000	1.0	Auto-Radio Dials and Flashlights		23/32	15/16	50
White	Bayonet	G-3½	51	6-8	7.5	0.2	1000	1.0	Auto-Radio Dials and Panel Boards	Frosted Bulb	½	15/16	51
White	Screw	G-4½	----	6-8	6.5	0.4	500	1.75	Auto-Radio Dials and Flashlights		—	—	----
White	Bayonet	G-4½	55	6-8	6.5	0.4	500	1.75	Auto-Radio Dials & Parking Lights		½	1⅛	55
White	Screw	T-3¼	292	2.9	2.9	0.17	—	—	Dials	Use in 2.5 V. sets where line voltage is high	29/32	1⅛	292
White	Bayonet	T-3¼	292-A	2.9	2.9	0.17	—	—	Dials & Coin Mch's	Use in 2.5 V. sets where line voltage is high	23/32	1⅛	292-A
Brown	Screw	G-5	1455	18.0	18.0	0.25	—	—	Coin Mch's	—	—	—	1455
Brown	Bayonet	G-5	1455A	18.0	18.0	0.25	—	—	Coin Mch's	—	—	—	1455A

*G.E. and Sylvania lamps have *0.35* amp. filament. Raytheon, National Union, and Tung-Sol lamps have *0.5* amp. filament.
†G.E. and Sylvania lamps have a *white* bead. Raytheon, National Union, and Tung-Sol lamps have a *green bead.*
**Sylvania Types 47 and 49 are interchangeable with Types 40 A and 49A, respectively, in other brands.

Base Styles

Dial lamps used up to a few years ago all had the miniature *screw* type of base (see Fig. 33-1).

One of the main objections to this type of base for radio receiver use is that the normal audio-frequency sound vibrations present in the receiver vibrate the lamps loose in the sockets, causing them to go out (and often causing growling noises in the sets as well.) If the socket is "crimped" and the lamp then forced in, it is tighter of course, but it is likely that this "forcing" will crack the bulb below the top line of the base. Such a minute crack will naturally shorten the life of the lamp due to air leakage. It is also difficult to remove such lamps from the sockets. All this may be avoided by putting a drop of coil "dope," sealing wax, or a bit of scotch tape where the socket rim and lamp base meet, in order to keep the screw-type base from unscrewing from the socket.

For the past few years, dial lamps with a miniature *bayonet base* (just like that employed on the common automobile types of lamps except that it is smaller) have been made available for radio set use (see illustration in Fig. 33-1). As this type of base eliminates all difficulties due to loosening of the lamps by vibration, it is rapidly gaining in use and popularity.

Life of Pilot and Dial Lamps

The life of the lamp depends manly upon its design, and the actual voltage it is operated at in service. The latter is a very important factor.

Therefore all life ratings for these lamps are based upon operation at what is termed the *design voltage* (see the *Design Volts* and *Average Hours Life at Design Volts* columns in the accompanying *Lamp Characteristic Chart*). It should also be remembered that while the "average" life of any group of lamps is a known factor, due to manufacturing variations, the exact "actual" life of any lamp is unpredictable.

Lamp Identification for Replacement—by RMA Color Code

The replacement of pilot and dial lamps should be made with lamps bearing the same type number (with the exception that *Sylvania* Types 47 and 49 lamps are interchangeable with Types 40A and 49A, respectively, in other brands).

If the markings on the lamp to be replaced are not legible, it is a simple matter to identify the lamp by its glass bead color. The filament lead wires are mounted through a small colored glass bead located immediately above the bulb press. The *color* of this glass bead identifies the lamp type. The *Bead Color* of each lamp type is shown in the left-hand column of the accompanying *Characteristics Chart*. Notice that some colors are used for identifying more than one particular type of lamp. In such cases, other features, such as the type of bulb and base, or the rated voltage, serve to help in the identification. Notice that those columns listing the *known* facts about a lamp which is to be replaced have been arranged at the left, for speedy reference.

The *No. 50* and *51* lamps are not in a true sense radio dial lamps. They were designed primarily for automotive service. While they are satisfactory for use in remote-control heads of auto-radio sets, they are not as strong and cannot withstand audio-frequency vibration as well as the *No. 44* lamp for example.

Importance of Using Proper Replacement Lamp

It is extremely important that the proper dial lamp replacements be used in a given receiver.

This is especially true when replacing dial lamps in sets having series or series-parallel arrangements of tube filaments and dial lights. In battery sets, the wrong dial lamp may cause too great a drain on the A battery and seriously shorten its life. In tuning meters, it is also extremely important to replace with exactly the same type of lamp.

RMA MOLDED RESISTOR, FLEXIBLE RESISTOR, AND RESISTOR-CORD COLOR CODES

THE Standards Committee of the Radio Manufacturers Association (RMA) has adopted a standard color code for the resistance-value and tolerance identification-marking of fixed resistors of the molded and the flexible type. This code enables one to quickly determine the resistance value of such a fixed resistor (within its tolerance limits) by visual inspection of the various colored bands or dots painted on it. The RMA color code has been in use for some time, and most fixed resistors employed in radio receivers are marked in accordance with it—although, as we shall see presently (Fig. 34-1), several different marking arrangements have come into use.

The special value of a knowledge of the RMA resistor color code to radio service men is twofold:

(1) If a color-coded resistor in a radio receiver "opens", "shorts", becomes "noisy", or becomes faulty in some other way, the color code enables the service man to identify its resistance value practically at a glance, so that a replacement resistor of the proper resistance value may be used.

(2) The service man may quickly identify the values of fixed resistors which are to be used for replacement purposes.

As most of the modern receivers service men are called upon to repair employ fixed resistors color-coded in accordance with this Standard RMA resistor color code, it is important that it be memorized so that the resistance values of all such resistors can be identified practically at a glance.

Since some manufacturers do not use this standard color code, due caution must be observed to determine whether or not the molded resistors in the radio set or instrument are, or are not, marked in accordance with the color code given here. A quick check of the resistance value of a few of the resistors with an ohmmeter, and a comparison of the resistance values measured with those indicated by the code markings will quickly establish whether or not the resistors are marked according to this standard RMA color code. Another practice is to refer to the receiver manufacturer's service charts, or to a reliable service manual for the resistor values when necessary.

RMA CODE COLOR DESIGNATION TABLE

Color	*Figure*
Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Gray	8
White	9

The Colors used in the RMA Resistor Color Code, and the Figures they Designate

Standardized color-coding for resistance-value identification is confined to the use of the *ten* different colors listed in the accompanying table—each definite color being assigned to designate the particular numerical figure indicated.

Thus, the color *black* always indicates the figure *zero*. The color *brown* always indicates the figure *1*. The color *blue* always indicates the figure *6*, etc.

Basis of the RMA Resistor Color Code System

The basis of the RMA Resistor Color code system is that all resistance values (in *ohms*) may be indicated by means of a system of *three* of the foregoing colors painted on the resistor in the form of narrow bands, dots, or as a body color. The percent tolerance in the resistance value may be indicated by a fourth band of color. As we shall see later (Fig. 34-1), different resistor and receiver manufacturers have adopted several different convenient arrangements for marking these color bands and dots on the resistors, but after these arrangements are studied, it will become apparent that the same *basic* system of identification applies to all of them. This system is as follows:

(1) the *first* figure of the resistance value in ohms is represented by one of the colors.

(2) the *second* figure is represented by another one of the colors.

(3) the *number of zeros* following the second figure is represented by the third color.

(4) the percent tolerance in the indicated resistance value is represented by the fourth color. *Gold* used for 5 percent tolerance, *silver* for 10 percent tolerance, and resistors rated at 20 percent tolerance bear no tolerance-indicating color.

Arrangements Used Commercially for Marking the Color Dots and Bands on Molded and Flexible Fixed Resistors

The five colored-dot and band marking arrangements shown in Fig. 34-1 have been used by the various manufacturers at one time or another to color-code their resistors in accordance with the RMA color code. Therefore, since the service man is apt to run across any one of them on the resistors in receivers he is called upon to

service, he should be familiar with *all* of them. They are all in accordance with the basic RMA color code.

In arrangements No. 1 and No. 2 (which have been used extensively for color coding molded resistors having radial-type pigtail leads:

(1) the *first* figure of the resistance value in ohms is indicated by the *body* color (A) of the resistor (according to the code in the table just presented).

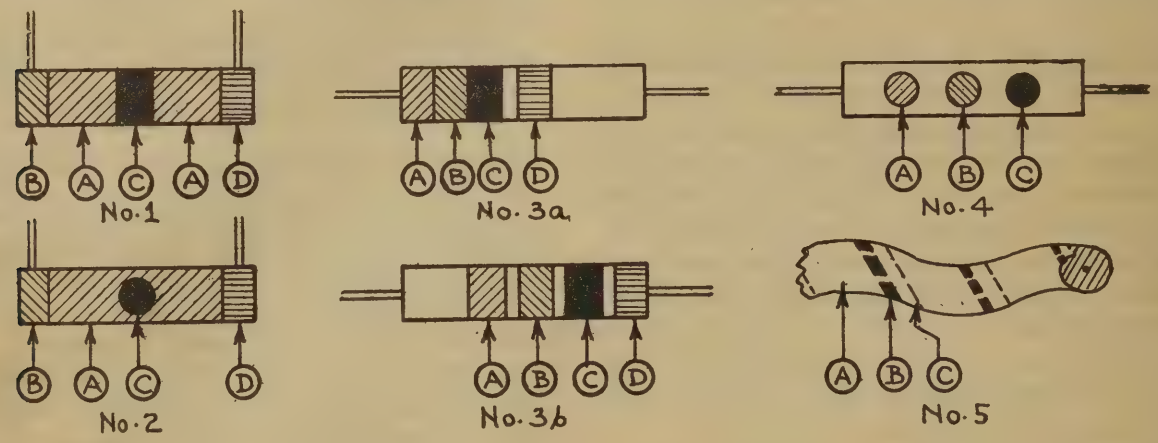
(2) the *second* figure is indicated by the color of one *end* (B) of the resistor.

(3) the *number of zeros* (O) following the second figure is indicated by the color of a *band* (C) —(arrangement No. 1), or a *dot* (C)—(in arrangement No. 2), at the center. When no center band or dot exists, it is to be assumed that the band, or dot is of the same *color* as the body and the number of zeros is judged from that color.

(4) the *per cent tolerance* of the resistance value is indicated by another colored *band* (D) (either *gold* or *silver*) at the other end of the resistor. (In its absence, the tolerance value is assumed to be ± 20%.)

Example: Suppose the "body" of a resistor marked in this way is *blue*, the tip is *red* and the central *band* is *black*. What is the value of the resistor?

Solution: As seen in the foregoing RMA Code Color Table, *blue* corresponds to the figure *6*, *red* to the figure *2*, and the band-color *black* means that there are *no* zeros following the second figure. The resistor therefore has a value



(A)		(B)		(C)		(D)	
Color	*First Figure*	*Color*	*Second Figure*	*Color*	*No. of Zeros following 2nd figure*	*Color*	*Tolerance %*
Black	0	Black	0	Black	none	Gold	± 5%
Brown	1	Brown	1	Brown	0	Silver	±10%
Red	2	Red	2	Red	00	No color	±20%
Orange	3	Orange	3	Orange	,000		
Yellow	4	Yellow	4	Yellow	0,000		
Green	5	Green	5	Green	00,000		
Blue	6	Blue	6	Blue	,000,000		
Violet	7	Violet	7	Violet	0,000,000		
Gray	8	Gray	8	Gray	00,000,000		
White	9	White	9	White	000,000,000		

Key: (A)—Color indicating *first* significant figure of resistance value in ohms.
(B)—Color indicating *second* significant figure.
(C)—Color indicating *number of zeros* following the second figure.
(D)—Color indicating *tolerance percent* in the resistance value.

Fig. 34-1—Direct-Reading RMA Fixed Resistor Color Code Chart. To read the value of any RMA color-coded resistor, find the corresponding pictorial illustration of the unit at the top. Now note the colors used on the resistor for code markings (A), (B), (C), (D). Refer to the chart for the figure corresponding to each color, and arrange these figures in the proper sequence. For example, if the (A) color of a carbon resistor is *brown*, the (B) color is *green*, the (C) color is *yellow* and the (D) color is *gold*, referring to the chart we see that the resistance value is *150,000 ohms*, with a tolerance of ±5 per cent.

If the body color of a flexible resistor is *red*, and it has a *green* thick thread and a *brown* thin thread woven through it, its color sequence (A) — (B) — (C) is red — green — brown. Its resistance value is therefore *250 ohms*.

of *62 ohms.* (If the band color had been *brown*, then the resistor value would be 620 ohms, since the color *brown* corresponds to the number 1, which means that there is one zero following the first two digits.)

The *consecutive* colored band arrangement shown in two slightly different forms at No. 3a and No. 3b in Fig. 34-1 is a later marking arrangement widely used on molded resistors—especially those provided with axial-type pigtail leads. It employs the same RMA Standard color and number code, but does not use a body color, or colored dots. The entire code coloring consists of three (or four) parallel colored bands located off-center on the resistor. In the marking arrangement shown at No. 3a, the three (or four) bands are arranged side by side with the end band (A) indicating the *first* significant figure of the resistance value. This is used on Centralab, IRC, and several other well known makes of resistors. The band arrangement shown at No. 3b, which is used by some receiver manufacturers differs only in the position of the bands. Here, the three bands are located off center on the resistor with the starting color band (A) nearest the center. Arrangement No. 3b really amounts to arrangement No. 3a with all the bands shifted over to the right until the (D) band is at the end. The band colors are read in exactly the same way for arrangements No. 3a and No. 3b—*consecutively* from left to right in the sequence (A)—(B)—(C)—(D)--and the colors are interpreted as follows:

(1) the *first* figure of the resistance value in ohms is indicated by the color of the *first* color band (A).

(2) the *second* figure is indicated by the color of the *second* band (B).

(3) the *number of zeros* following the second figure is indicated by the color of the *third* band (C).

(4) the *per cent of tolerance* of the resistance value is indicated by the color of the fourth band (D). (In its absence, the tolerance value is assumed to be ± 20%.)

Example: Referring to code marking arrangement No. 3a in Fig. 34-1 suppose the tip band (A) color is *orange*, the second band (B) color is *yellow*, the third band (C) color is *red*, and the fourth band (D) coolr is *gold*. What is the value of the resistor?

Solution: Since the first band color is *orange*, the first figure is *3;* since the second band color is *yellow*, the second figure is *4;* since the third band color is *red*, there are two zeros (*00*) following these numbers. The resistance value is therefore *3,400 ohms.*

Since the fourth band is gold, the tolerance is ±5%. Therefore, the actual value of the resistor (as measured by an ohmmeter) may properly be anything between *3,570* ohms and *3,230* ohms.

Some molded resistors look like small, narrow, mica condensers. These are ordinarily RMA color-coded by means of three indentifying colored dots placed as illustrated at No. 4 in Fig. 34-1. These dot colors are read in the sequence (A)—(B)—(C), in the same manner as explained for the marking arrangement of No. 3a.

Color Coding of Flexible Type Resistors

Flexible fabric-covered wire-wound fixed resistors are also RMA coded by three identifying colors, the same as molded resistors. Some have the colors woven into the fabric, as shown at No. 5 in Fig. 34-1 and the method of identification is as follows:

(1) the *body* color (A) represents the *first* figure of the resistance value in ohms.

(2) the *thickest thread* (triple thread) color (B) represents the *second* figure.

(3) the *thinnest thread* (single-thread) color (C) represents the *number of zeros* following the two figures.

If either the thick or the thin thread color is missing in a flexible resistor it is assumed to be there, carrying the color of the body (whatever it may be).

Time-Saving Direct-Reading RMA Fixed-Resistor Color Code Chart

All of the foregoing information regarding the RMA fixed-resistor color code and the various code color marking arrangements employed by various manufacturers has been summarized in the direct-reading chart of Fig. 34-1 for convenience and rapid reference.

Do not be confused in the case of resistors where only *two* colors are present. If, for example, no center dot or band exists on a resistor bearing a body color, it must be assumed that the dot or band is the same *color* as the body. Likewise, if either the large or the small thread color is missing in a flexible resistor, it is assumed to be there, carrying the color of the body (whatever it may be).

Why Some Radio Manufacturers Employ Odd-Value Resistors because of Color Code Identification Difficulties

Some of the larger radio manufacturers—for example Philco—employ mercury-vapor lamp lighting in their assembly plants. Certain colors are difficult to distinguish under the bluish-green light of these lamps. To overcome this difficulty, in such cases, these manufacturers employ odd-values of resistors. For example, the *black* in the green—black—orange color coding of a 50,000-ohm resistor is not clearly distinguishable under this light. Therefore, instead of using 50,000-ohm resistors, 51,000 ohm units are used instead, since each of the code colors (green—*brown*—orange) for this value of resistance show up sufficiently well. Likewise 99,000-ohm resistors are used instead of 100,000-ohm units, etc. In practically all cases where such odd-value resistors are found in a receiver chassis, the next higher "even" value of resistor may be used satisfactorily for replace-

(Cont'd over)

ment purposes if it is more convenient to do so on any service job.

RMA Resistor-Cord Color Code

There is a special RMA Standard color code employed for identifying the value of resistance employed in resistor cords such as the type which has been widely used in ac-dc radio receivers for voltage-dropping purposes. The resistor cord has 3 separate wires coming out. Two come directly from the line plug, and one comes from the resistor. The two line wires are always either *red* and *blue* or *red* and *black*. The color of the third wire (the *resistor* wire) depends on the value of the resistor employed in the cord, it being colored according to the following code:

Color	*Resistance*
Yellow	135 ohms
Blue	160 ohms
White	180 ohms
Green	200 ohms
Light Brown	220 ohms
Orange	260 ohms
Grey	290 ohms
Maroon	315—320 ohms
Dark Brown	350—360 ohms

— 35 —

RMA STANDARD MOLDED RESISTOR "PREFERRED VALUE" CHART*

THE application of Ohm's law in calculating the values of resistance to be used in vacuum tube circuits, often results in answers involving "odd" values of resistance, since the currents and voltages are determined largely by the operating characteristics of the tubes. Obviously, it is not feasible to design tube characteristics to conveniently suit pre-determined "even" values of components such as resistors. The problem confronting the circuit design engineer, namely, that of selecting fixed resistors whose values will fulfill the requirements of the circuit and at the same time be easily obtainable and readily replaceable, has been made less involved by the standardization of a group of *Preferred Values of Fixed Composition Resistors* by the RMA. Many radio receiver manufacturers are now limiting the resistor values used in their sets to the RMA "Preferred" values, for convenience. Adherence to the standardization eliminates the necessity of maintaining large stocks of replacement resistors whose values are seldom used, and simplifies the replacement of resistors in servicing work.

The RMA Standardized Preferred Resistance Values

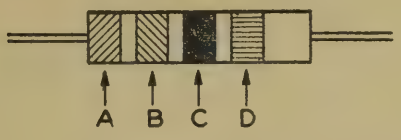
The standardized Preferred Resistance Values (see accompanying chart) are divided into three tolerance groups, ±20%, ±10%, and ±5%. Where the voltage drop across the resistor is somewhat critical, as in bias resistors, use of the 10% tolerance group is the most practical and economical. Only in special cases will resistors of the 5% tolerance group need to be used. The resistors tabulated in the accompanying chart furnish a complete line of values which will meet the majority of circuit and replacement requirements. In each case, the RMA standard color code designation for the resistor (see *Section 34* of this *Handbook*) is also listed for convenience in rapid identification of the resistance value.

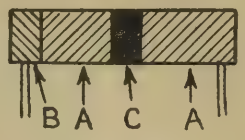
What to do when a Resistor of "Calculated" Value is not Found on the Preferred List

After applying Ohm's law to calculate a resistor value to be employed, it frequently occurs that a resistor of the calculated value is not found on this "Preferred" list. In such cases it is, of course, desirable to *choose the resistor of nearest value to it,* either larger or smaller according to the characteristics of the circuit it is to be used in. For example, if the value of a cathode bias resistor is calculated to be 110 ohms, it is found that the nearest values in the 10% tolerance group are 100 ohms and 120 ohms. In such a case the plate and screen voltages should be taken into consideration. If the plate and screen voltages are high, then it is desirable to use the resistor that will provide more bias (in order to safeguard tube life and operating characteristics), and hence the 120-ohm unit should be used. In cases where the voltages tend to run low, the lower value resistor may be used. The same reasoning applies to screen and plate resistors which are, in general, not as critical as cathode bias resistors. This reasoning applies, for example, to the resistor values shown in the Grid Bias Resistor Chart in *Section 16* of this *Handbook*.

PLEASE SEE NEXT PAGE FOR CHART

CHART OF RMA PREFERRED VALUES OF FIXED COMPOSITION RESISTORS





"Preferred" Values of Resistance (ohms)			Resistance Designation (RMA Color Code)		
± 20% D-No Color	± 10% D-Silver	± 5% D-Gold	A	B	C
10	10	10	Brown	Black	Black
		11	Brown	Brown	Black
	12	12	Brown	Red	Black
		13	Brown	Orange	Black
15	15	15	Brown	Green	Black
		16	Brown	Blue	Black
	18	18	Brown	Gray	Black
		20	Red	Black	Black
22	22	22	Red	Red	Black
		24	Red	Yellow	Black
	27	27	Red	Violet	Black
		30	Orange	Black	Black
33	33	33	Orange	Orange	Black
		36	Orange	Blue	Black
	39	39	Orange	White	Black
		43	Yellow	Orange	Black
47	47	47	Yellow	Violet	Black
		51	Green	Brown	Black
	56	56	Green	Blue	Black
		62	Blue	Red	Black
68	68	68	Blue	Gray	Black
		75	Violet	Green	Black
	82	82	Gray	Red	Black
		91	White	Brown	Black
100	100	100	Brown	Black	Brown
		110	Brown	Brown	Brown
	120	120	Brown	Red	Brown
		130	Brown	Orange	Brown
150	150	150	Brown	Green	Brown
		160	Brown	Blue	Brown
	180	180	Brown	Gray	Brown
		200	Red	Black	Brown
220	220	220	Red	Red	Brown
		240	Red	Yellow	Brown
	270	270	Red	Violet	Brown
		300	Orange	Black	Brown
330	330	330	Orange	Orange	Brown
		360	Orange	Blue	Brown
	390	390	Orange	White	Brown
		430	Yellow	Orange	Brown
470	470	470	Yellow	Violet	Brown
		510	Green	Brown	Brown
	560	560	Green	Blue	Brown
		620	Blue	Red	Brown
680	680	680	Blue	Gray	Brown
		750	Violet	Green	Brown
	820	820	Gray	Red	Brown
		910	White	Brown	Brown
1000	1000	1000	Brown	Black	Red
		1100	Brown	Brown	Red
	1200	1200	Brown	Red	Red
		1300	Brown	Orange	Red
1500	1500	1500	Brown	Green	Red
		1600	Brown	Blue	Red
	1800	1800	Brown	Gray	Red
		2000	Red	Black	Red
2200	2200	2200	Red	Red	Red
		2400	Red	Yellow	Red
	2700	2700	Red	Violet	Red
		3000	Orange	Black	Red
3300	3300	3300	Orange	Orange	Red
		3600	Orange	Blue	Red
	3900	3900	Orange	White	Red
		4300	Yellow	Orange	Red
4700	4700	4700	Yellow	Violet	Red
		5100	Green	Brown	Red
	5600	5600	Green	Blue	Red
		6200	Blue	Red	Red
6800	6800	6800	Blue	Gray	Red
		7500	Violet	Green	Red
	8200	8200	Gray	Red	Red
		9100	White	Brown	Red

(Cont'd)

"Preferred" Values of Resistance (ohms)			Resistance Designation (RMA Color Code)		
± 20% D-No Color	± 10% D-Silver	± 5% D-Gold	A	B	C
10000	10000	10000	Brown	Black	Orange
		11000	Brown	Brown	Orange
	12000	12000	Brown	Red	Orange
		13000	Brown	Orange	Orange
15000	15000	15000	Brown	Green	Orange
		16000	Brown	Blue	Orange
	18000	18000	Brown	Gray	Orange
		20000	Red	Black	Orange
22000	22000	22000	Red	Red	Orange
		24000	Red	Yellow	Orange
	27000	27000	Red	Violet	Orange
		30000	Orange	Black	Orange
33000	33000	33000	Orange	Orange	Orange
		36000	Orange	Blue	Orange
	39000	39000	Orange	White	Orange
		43000	Yellow	Orange	Orange
47000	47000	47000	Yellow	Violet	Orange
		51000	Green	Brown	Orange
	56000	56000	Green	Blue	Orange
		62000	Blue	Red	Orange
68000	68000	68000	Blue	Gray	Orange
		75000	Violet	Green	Orange
	82000	82000	Gray	Red	Orange
		91000	White	Brown	Orange
100000	100000	100000	Brown	Black	Yellow
		110000	Brown	Brown	Yellow
	120000	120000	Brown	Red	Yellow
		130000	Brown	Orange	Yellow
150000	150000	150000	Brown	Green	Yellow
		160000	Brown	Blue	Yellow
	180000	180000	Brown	Gray	Yellow
		200000	Red	Black	Yellow
220000	220000	220000	Red	Red	Yellow
		240000	Red	Yellow	Yellow
	270000	270000	Red	Violet	Yellow
		300000	Orange	Black	Yellow
330000	330000	330000	Orange	Orange	Yellow
		360000	Orange	Blue	Yellow
	390000	390000	Orange	White	Yellow
		430000	Yellow	Orange	Yellow
470000	470000	470000	Yellow	Violet	Yellow
		510000	Green	Brown	Yellow
	560000	560000	Green	Blue	Yellow
		620000	Blue	Red	Yellow
680000	680000	680000	Blue	Gray	Yellow
		750000	Violet	Green	Yellow
	820000	820000	Gray	Red	Yellow
		910000	White	Brown	Yellow
1.0 Meg.	1.0 Meg.	1.0 Meg.	Brown	Black	Green
		1.1 Meg.	Brown	Brown	Green
	1.2 Meg.	1.2 Meg.	Brown	Red	Green
		1.3 Meg.	Brown	Orange	Green
1.5 Meg.	1.5 Meg.	1.5 Meg.	Brown	Green	Green
		1.6 Meg.	Brown	Blue	Green
	1.8 Meg.	1.8 Meg.	Brown	Gray	Green
		2.0 Meg.	Red	Black	Green
2.2 Meg.	2.2 Meg.	2.2 Meg.	Red	Red	Green
		2.4 Meg.	Red	Yellow	Green
	2.7 Meg.	2.7 Meg.	Red	Violet	Green
		3.0 Meg.	Orange	Black	Green
3.3 Meg.	3.3 Meg.	3.3 Meg.	Orange	Orange	Green
		3.6 Meg.	Orange	Blue	Green
	3.9 Meg.	3.9 Meg.	Orange	White	Green
		4.3 Meg.	Yellow	Orange	Green
4.7 Meg.	4.7 Meg.	4.7 Meg.	Yellow	Violet	Green
		5.1 Meg.	Green	Brown	Green
	5.6 Meg.	5.6 Meg.	Green	Blue	Green
		6.2 Meg.	Blue	Red	Green
6.8 Meg.	6.8 Meg.	6.8 Meg.	Blue	Gray	Green
		7.5 Meg.	Violet	Green	Green
	8.2 Meg.	8.2 Meg.	Gray	Red	Green
		9.1 Meg.	White	Brown	Green
10.0 Meg.	10.0 Meg.	10.0 Meg.	Brown	Black	Blue

*Reprinted by courtesy the *RMA Engineering Dept.* and *Hygrade Sylvania Corp.*

RMA STANDARD MOLDED MICA CONDENSER COLOR CODE—AND CHART

WHEN the ratings of receiver type molded mica fixed condensers are not actually stamped on the case a standard RMA color coding is used to indicate them.

The RMA condenser color code is inherently similar in principle to that already explained for molded resistors (in *Section 34 of this Handbook*). As will be seen from the tabulation in Fig. 36-1, the various code colors used for indicating the significant figures and the number of zeros are exactly the same as those used in the molded resistor color code (explained in *Section 34*, and illustrated in Fig. 34-1 of this *Handbook*), and have exactly the same "number" significance as do those in the resistor color code. For example, *brown* stands for the digit *1* in both codes, *yellow* stands for the digit *4* in both codes, etc. This similarity should aid in remembering the codes.

3-Dot RMA Molded Mica Condenser Capacity Marking

When the working voltage of the condenser is 500 volts d-c and the tolerance ± 20% a simple 3-dot marking is invariably used (see illustrations No. 1a, No. 1b and No. 1c in Fig. 36-1). The significance of each dot color then is as follows:

(1) the color of the *first* dot (*A*) (on the "trademarked" side of the case and reading from left to right) indicates the *first* significant figure of the condenser capacity in *micromicrofarads** (*mmfd.*)—according to the standard RMA code-color designation system—see chart in Fig. 36-1.

(2) the color of the *second* dot (*B*) indicates the *second* significant figure.

(3) the color of the *third* dot (*C*) indicates the *number of zeros* following the first two figures.

The color dots must be read in the correct sequence (*A*)—(*B*)—(*C*)—from *left* to *right* in order to correctly interpret the color code. In order to make certain that the condenser will be held in the proper position while the dots are being read, manufacturers have adopted several 3-dot marking arrangements. In that shown in illustration No. 1a in Fig. 36-1, the condenser must be held so that the manufacturer's name or trademark appears right side up, as shown. Then the dots will be read in the proper sequence if they are read from *left to right*. On some makes of condensers, the dots are shaped so they are slightly "pointed" in the direction in which they are to be read, others have an adjacent direction-arrow molded alongside each dot as shown in illustration No. 1b. Another somewhat similar arrangement is shown in No. 1c. Here, the three colored dots are stamped on an arrow molded in the condenser case. The arrow always points to the correct direction of reading, i.e., the dots are read from the tail toward the head of the arrow.

Example:

Red Green Black = 25 mmfd. = 0.000025 mfd.

Extra Markings for Voltage Rating & Capacity Tolerance (5-Dot Color Code)

On types where two extra color dots appear (making 5 in all), whether on the face or on the reverse side of the molded case, the color of the *fourth* dot (D) indicates the *d-c voltage rating*, in accordance with the tabulation of the (D) column in Fig. 36-1. (**Example:** *Blue* = 600 volts d-c.) No color in this position implies a voltage rating of 500 volts d-c.

The color of the *fifth* dot (E) indicates the *percent tolerance* in the accuracy of the capacity rating; see (E) column in Fig. 36-1. (**Example:** *Green* indicates a ± 5% tolerance.) No color in this position indicates a tolerance of ± 20% in the capacity value. A condenser with the 5-dot color code is shown in illustration No. 2 in Fig. 36-1.

6-Dot Color Code

When there are three significant figures in the capacity value (as in the case of a condenser of 1250 mmfd.) and the voltage rating and tolerance information is also to be indicated, a 6-dot color code is usually employed.

On condensers marked with six dots (see illustration No. 3 in Fig. 36-1) the upper three dots indicate the three significant figures of the capacity and the lower right hand dot indicates the number of zeros to be added. The remaining two dots (D) and (E) indicate the *d-c working voltage* rating and the *capacity tolerance* respectively, as shown in the illustration.

(Cont'd)

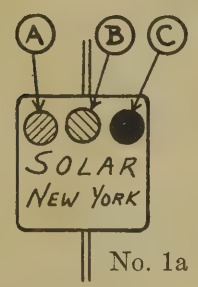
*Note: A micro-microfarad is one millionth (1/000,000) of a microfarad. To convert mmfd. to mfd., move the decimal point *six* places to the left. (For example, 3500. mmfd. is equivalent to 0.0035 mfd.). To convert mfd. to mmfd., move the decimal point *six* places to the *right*. (For example, 0.00025 mfd. is equivalent to 250 mmfd.). For additional information on Conversion of Units and Metrix Prefixes see *Section 65* of this *Handbook*.

Example:

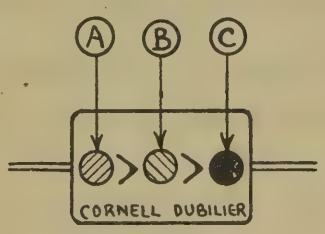
Brown Red Green } = 1250 mmfd.
Orange Green Brown } 300 v. d-c working voltage
±5% tolerance in capacity

Silvered-Mica Condenser Identification

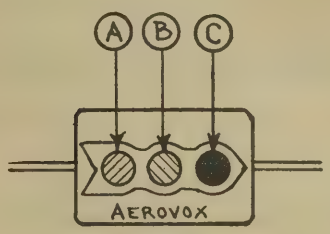
Silvered-mica condensers usually are distinctly marked, either with a silver dot placed in the center of the molded body or by the use of a molding material of distinctive color.



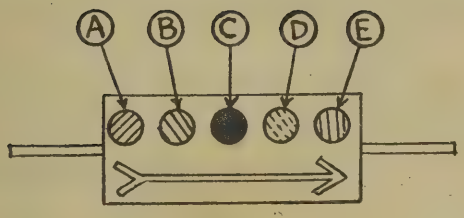
No. 1a



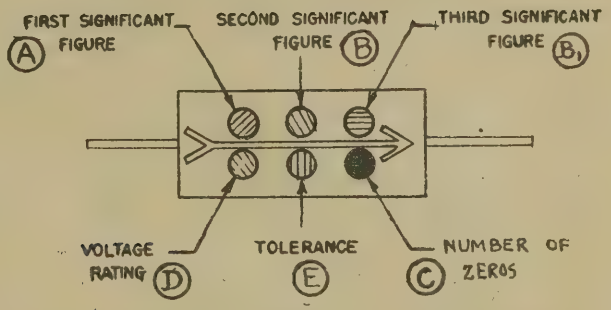
No. 1b



No. 1c



No. 2



No. 3

(A)		(B)		(C)		(D)		(E)	
First Dot	*First Figure*	*Second Dot*	*Second Figure*	*Third Dot*	*Number of Zeros following Second Figure*	*Voltage Dot*	*Voltage Rating (dc)*	*Tolerance Dot*	*Tolerance %*
Black	0	Black	0	Black	none	Brown	100	Brown	±1
Brown	1	Brown	1	Brown	0	Red	200	Red	±2
Red	2	Red	2	Red	00	Orange	300	Orange	±3
Orange	3	Orange	3	Orange	000	Yellow	400	Yellow	±4
Yellow	4	Yellow	4	Yellow	0,000	Green	500	Green	±5
Green	5	Green	5	Green	00,000	Blue	600	Blue	±6
Blue	6	Blue	6	Blue	,000,000	Violet	700	Violet	±7
Violet	7	Violet	7	Violet	0,000,000	Gray	800	Gray	±8
Gray	8	Gray	8	Gray	00,000,000	White	900	White	±9
White	9	White	9	White	000,000,000	Gold	1,000	Gold	
						Silver		Silver	±10
						No Color	500	No Color	±20

Key: (A)—Dot color indicating *first* significant figure of capacity value in micro-microfarads.
(B)—Dot color indicating *second* significant figure.
(C)—Dot color indicating number of *zeros* following the first two figures.
(D)—Dot color indicating the *dc voltage rating*.
(E)—Dot color indicating the *percent tolerance* in the accuracy of the capacity rating.

Fig. 36-1—Direct-reading RMA Molded Mica Condenser Color Code chart. See accompanying text for explanation.

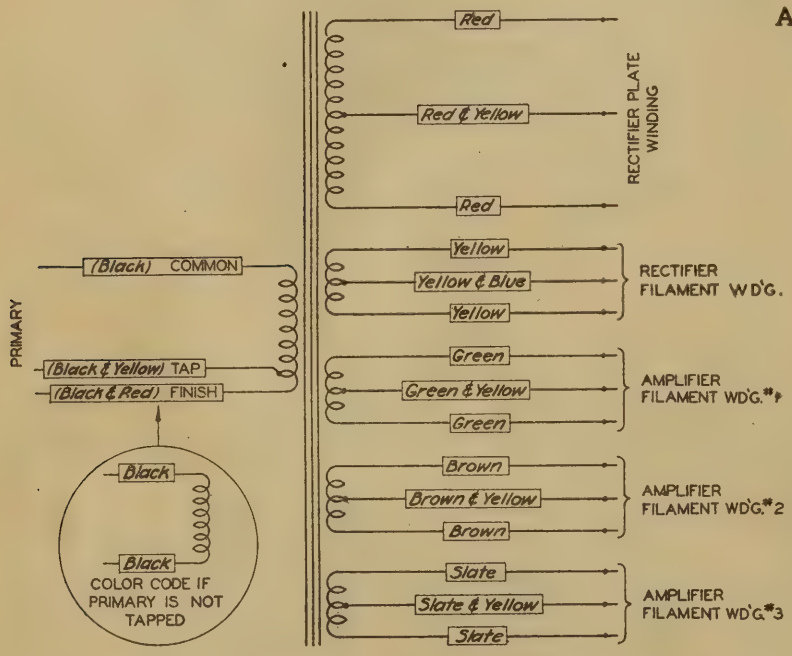
000100

RMA STANDARD "POWER", "I-F", "INTERSTAGE AUDIO" AND "OUTPUT AUDIO" TRANSFORMER LEAD COLOR CODES

(With instructions for also identifying the leads of transformers that are not Color Coded according to a known color code)

RMA Standard Power Transformer Lead Color Code

It is standard among member manufacturers of the RMA to use the following color code on the leads of power transformers for purposes of terminal identification. (This Color Code was adopted on May 17, 1935.)



Standard RMA Color Code for the leads of radio power transformers. (See accompanying text for explanation).

Primary Leads: If the primary winding is not tapped, both primary leads are *black*.

If the primary winding is tapped, the leads are as follows:

Common—*black*.

Tap—*black* and *yellow* 50/50 striped design

Finish—*black* and *red* 50/50 striped design

Rectifier Plate Winding: Outside leads—*red;*

Center Tap—*red* and *yellow* 50/50 striped design

Rectifier Filament Winding: Outside leads — *yellow;*

Center Tap—*yellow* and *blue* 50/50 striped design

Amplifier Fil. Winding No. 1: Outside leads — *green;*

Center Tap—*green* and *yellow* 50/50 striped design

Amplifier Fil. Winding No. 2: Outside leads — *brown;*

Center Tap—*brown* and *yellow* 50/50 striped design

Amplifier Filament Winding No. 3: Outside leads—*slate;*

Center Tap—*slate* and *yellow* 50/50 striped design

An illustration which shows the various windings of a power transformer with these color-code markings applied to its leads is presented herewith to aid in understanding this code so that, when it becomes necessary in service to check the operation or condition of the windings of the power transformer in a receiver (or install a replacement transformer in it) little time will be consumed in identifying the various leads.

RCA Power Transformer Lead Color Codes —Old and New

It should be understood that the standard RMA power transformer lead color code is not used on the transformers of all manufacturers. For example, up to the end of 1940 RCA used a special code (referred to below as the "Old Color Code"), so all RCA receivers manufactured previous to that time contain power transformers whose leads are coded according to this code. Changes have recently been made in the color code of RCA power transformer leads however, to conform with the RMA Standard Color Code. The color coding according to the old RCA system as compared with the

present RMA system is as follows:

	Old RCA Color Code	*New Color Code*
Rectifier filament	*green & red tr.*	*yellow*
Amplifier filament	*blue*	*brown*
Hi-voltage secondary	*brown*	*red*
Hi-voltage center tap	*brown & black*	*red & yellow*
There are three different types of primaries as follows:		
Single 110-volt primary	*red*	*black*
Double primary— 110-120 volts:		
No. 1 Primary—Start	*red*	*black*
No. 1 Primary—Finish	*red & black*	*black & yel.*
No. 2 Primary—Start	*red & yel.*	*black & green*
No. 2 Primary—Finish	*black & red tr.*	*black & red*
Tapped primary— 110-125-150-210-240 V.:		
Start	*red*	*black*
110 volt tap	*red & black*	*black & yel.*
Finish	*black & red tr.*	*black & red.*

These transformers are interchangeable since no change has been made in their electrical characteristics. Transformers supplied for replacement purposes using the new color code leads are shipped less end shields (covers). The end shield from the original transformer should be used. If the lower shield is of the bent lug type, it need not be removed from the chassis.

How to Trace and Identify the Leads of a Power Transformer that is not Color Coded According to a Known Color Code

It is not difficult to identify the various leads of an uncoded power transformer connected in a receiver if the following series of voltage and resistance tests are made, and these are interpreted with some knowledge of ordinary receiver design.

To trace the *primary* leads, start from the power cord of the receiver and trace the wiring back to the power transformer. The line voltage should not be present across the primary winding, i.e., receiver switch should be turned "off" when this is done. Now the resistance of the winding thus located may be checked with an ohmmeter. (When checking the windings for resistance, all tests must be made with the a-c line voltage disconnected.) The resistance of the primary winding should measure from about 3 to 10 ohms, as the wire is large because of the heavy current it must carry without overheating.

The high-voltage secondary is usually center-tapped, and the center tap grounded, *but not always*. Locate the tube base terminals which terminate the two rectifier tube plates. The two leads from the *outside* ends of the high-voltage secondary will terminate at these two points. The a-c voltage will usually run from about 225 to 400 volts from each of these leads to ground, or from about 450 to 800 a-c volts from one side to the other. As a comparatively small current flows in this secondary, it is wound of a large number of turns of small sized wire. Its resistance will be around 200 to 300 ohms from one outside lead to the other.

The filament winding leads are equally easy to spot. They always connected to the filament terminals of the various tube sockets. A check of voltages they develop should show approximately the filament voltages which are required by the types of tubes they serve (see Tube Characteristic Charts in *Section 22* of this *Handbook*). The rectifier tube has a separate filament winding. Usually the power tube (or tubes) also have a separate winding. As large wire is used for these windings, the resistance of each winding will be very low (from about 0.1 to 0.5 ohm).

RMA Standard I-F Transformer Lead Color Code

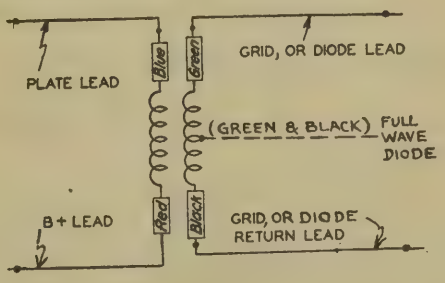
The standard RMA color code (adopted as standard on May 17, 1935) employed on the leads of intermediate-frequency transformers for purposes of terminal identification is as follows:

INPUT & INTERSTAGE I-F TRANSFORMERS

blue ——— Plate lead
red ——— B+ lead
green ——— Control-grid lead
black ——— AVC lead

OUTPUT I-F TRANSFORMERS

blue ——— Plate lead
red ——— B+ lead
green ——— Diode, or Control Grid
black ——— Grid, or Diode Return
green & black — Full Wave Diode



Standard RMA Color Code for the leads of intermediate-frequency transformers. (See accompanying text for explanation.)

This color code is shown pictorially in the illustration above.

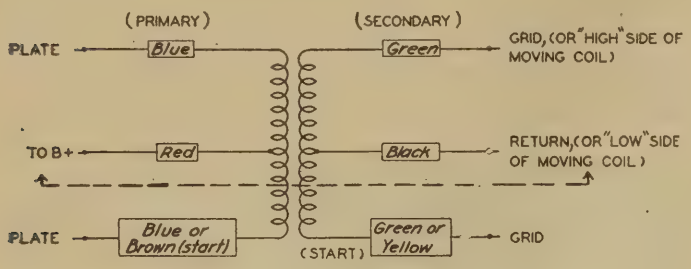
RMA Standard "Interstage" and "Output" Audio Transformer Lead Color Code

The standard RMA color code (adopted as standard on May 17, 1935) employed on the leads of audio-frequency transformers for purposes of terminal identifica-

tion is shown in the accompanying illustration:

For push-pull interstage and output transformers the color coding is as indicated in the diagram. In the case of single primary and/or single secondary transformers only the upper portion of the diagram (above the dotted line) is used.

When the polarity of the primary (and/or secondary) is not a factor, both outside leads may be the same color as indicated. Where polarity must be indicated, the *Brown* and *Yellow* leads shall indicate the start of the



Standard RMA Color Code for the leads of audio-frequency "interstage" and "output" transformers. (See accompanying text for explanation.)

primary winding and the start of the secondary winding respectively. In the case of an output transformer, the *Black* lead shall be the start of the secondary.

Many output transformers have soldering lugs for the secondary terminals, rather than leads. In such units, only the *primary* leads are colored according to the RMA coding.

How to Trace and Identify the Leads of an "Interstage" or "Output" Audio Transformer that is not Color Coded According to a Known Color Code

Interstage audio transformers are primarily voltage-amplifier couplers. Thus, they not only couple one audio amplifier tube to the next, but they, of themselves, furnish some voltage gain.

More audio transformers than power transformers are replaced in receivers because of the damaging effect of humidity and other weather conditions on the very fine copper wire with which they are wound. Many of the newer receivers use resistance coupling in the audio stages almost exclusively, but there are many older models in use which employ audio transformers.

Usually, the step-up voltage ratio is between 1:1 and 3:1.

To identify the leads of audio transformers which are not color coded according to a known color code, it is necessary first to determine between which two tubes in the circuit the transformer is used. This is done by tracing the leads back from the transformer to the tube socket terminals. Next, find the tube socket terminal for the *plate* element in the tube which feeds the audio transformer, and trace the attached wire back to the transformer. This goes to one of the *primary* leads. Find the *control-grid* terminals of the tube following the transformer, and trace the attached wire back to the audio transformer. This goes to one of the *secondary* leads. If the transformer is single-ended, there are two wires remaining. One is the other end of the *primary* winding, and runs to some *positive* potential point in the "B" supply circuit. The other is the other end of the *secondary*. This is either grounded, or runs to the avc circuit, or to a *minus* potential point in the "B" supply (for grid bias on the tube). Resistance tests across: *first*, the two primary leads and, *next*, the two secondary leads will determine if either winding is "open" or "shorted." As fine wire is used for these windings, a resistance reading of several hundred ohms is possible.

Double-ended interstage transformers are used where the primary, the secondary, or both are connected to push-pull stages. In this case, one additional lead from a push-pull primary runs to the *plate* of the other push-pull tube. In a push-pull secondary, the other lead runs to the *control-grid* of the other push-pull tube. A resistance check can be made between the center tap and each side of the push-pull winding. The resistance in each case should be approximately the same.

Checking the Turns Ratio and Impedance Ratio of an Output Transformer which is to be Replaced

The output transformer is essentially a *power*-delivering device, in comparison with the *voltage*-delivering interstage transformer. It must match (within reasonable limits) the plate impedance of the output tube (which may be as much as 15,000 ohms) to the impedance of the loudspeaker voice coil (which may be as little as 1 ohm).

In output transformer replacement work, it is always necessary not only to match these two impedances correctly, but also to install a transformer which will "take it" as far as current is concerned.

To determine the *ratio* of an output transformer, disconnect it from the receiver. Then apply about 2.5 volts a.c. to the *secondary* winding, and measure the voltage developed across the *primary*. The ratio between the two voltages is the transformer ratio.

RMA STANDARD DYNAMIC SPEAKER LEAD COLOR CODE & PLUG CONNECTIONS

WHEN one of the following six arrangements is used to connect an electrodynamic loud speaker to a radio receiver chassis, the standard RMA lead color code and connections to the speaker plug are as indicated in each of the accompanying illustrations. (This code was adopted as standard in November, 1936.)

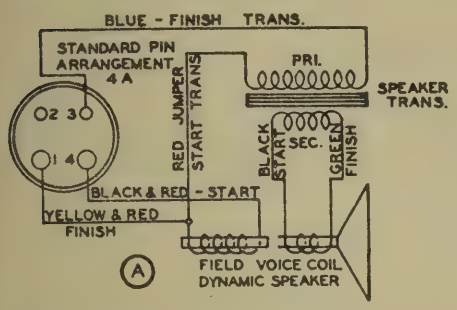


Fig. A—Standard 3-wire connections into a 4-prong plug. Only 3 leads are used, since the B+ (output) end of the field coil (used also as a B-filter in the receiver) and the B+ end of the primary of the output transformer are connected together and a common lead is brought out from them to the plug.

Plug shown with pins pointing toward you.

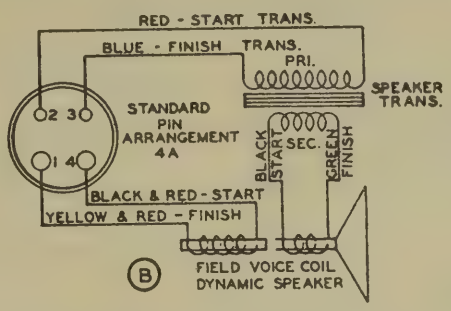


Fig. B—Standard 4-wire connection when a 4-prong plug is used. (This is the same as Fig. A with the exception that separate field B+ and output transformer B+ leads are brought out.)

Plug shown with pins pointing toward you.

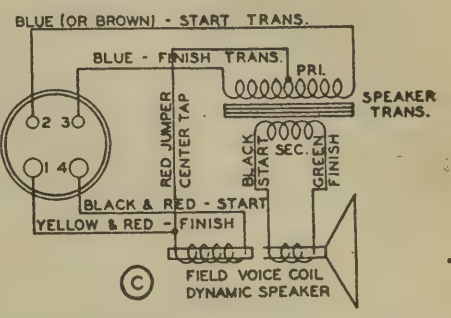


Fig. C—Standard 4-wire push-pull connection using a 4-prong plug. (As in Fig. A, the filter (field) output lead and the output transformer B+ lead use a common connection.)

Plug shown with pins pointing toward you.

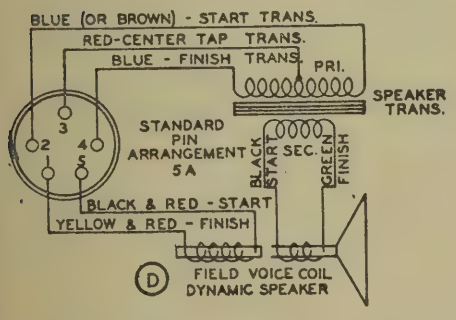


Fig. D—Standard 5-wire push-pull connection using a 5-prong plug.

Plug shown with pins pointing toward you.

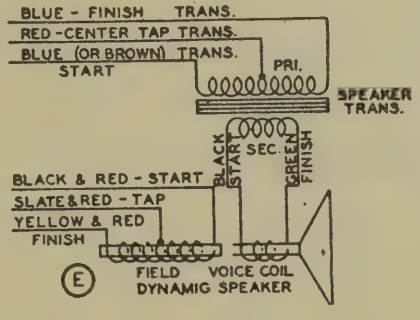


Fig. E—Color coding of the leads when the field coil is also tapped.

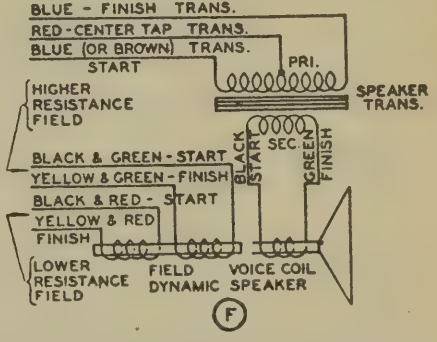


Fig. F—Color coding of the leads for a design in which two separate field coils are employed—one having a higher resistance than the other.

Note: When two fields are used on a single speaker, the field of *lower* resistance has leads using common *red* color; and the leads of the field having a *higher* resistance have a common *green* color. In the case of three fields, the fields having the *highest* resistance shall have a common *orange* color.

RMA Standard Color Code and Connections for Wiring Electro-Dynamic Loud Speakers.

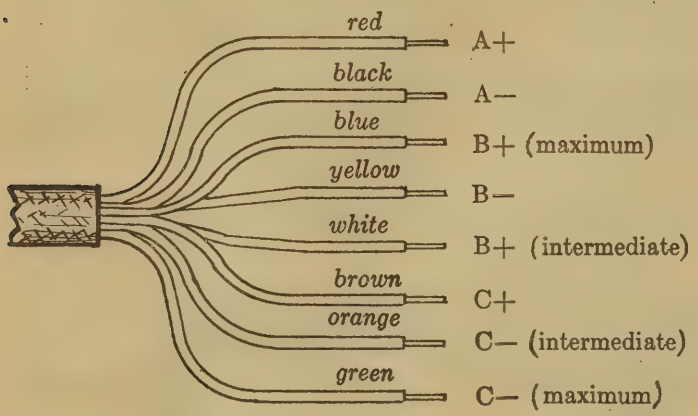
The start, tap, and finish of all windings occur in *clockwise* order around the plug pins when the plug is viewed with the pins toward you (as shown in the illustrations above).

All two-color leads have 50/50 striped designs.

STANDARD BATTERY CABLE LEAD AND PHONO-MOTOR COLOR CODES

NEMA Standard Battery Cable Lead Color Code

A standard color code has also been approved by the National Electrical Manufacturers Association (NEMA) for the wires comprising the cables used for connecting battery-operated receivers to the batteries. This wire code is not standard on all battery-operated receivers, but it is being used by manufacturer members of the N.E.M.A. The standard battery cable lead color code is illustrated in the accompanying illustration. All leads are solid color.



Standard RMA Color Code for the wires of battery cables. All leads are solid color.

Phono Motor Frequency Identification Color Code

A color code is used on many makes of phonograph motors for identifying the power-circuit frequency for which they are designed to operate. The motor is marked either on the bottom, or side, with a large spot of paint as follows:

no mark	60 cycles
green spot	50 cycles
white spot	25 cycles

RMA PROPOSED SYMBOLS FOR RADIO SCHEMATIC DIAGRAMS

FOLLOWING are the radio symbols which were proposed for standardization by the RMA in June 1938. While these have not as yet been officially adopted by the radio industry, many radio manufacturers are using them in their schematic circuit diagrams and service sheets. Hence, these symbols should be memorized by all radio service men as soon as possible.

"CHASSIS" GROUND

"EXTERNAL" OR "EARTH" GROUND

GANG SECTION OF VARIABLE AIR CONDENSER
(Arrow represents moving plates)

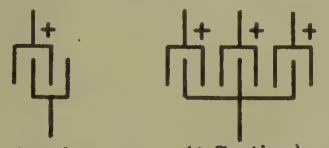
SMALL TRIMMER TYPE ADJUSTABLE CONDENSER

FIXED CONDENSER

"WET" ELECTROLYTIC CONDENSERS

(Single Section) *(3-Section)*

"DRY" ELECTROLYTIC CONDENSERS



(Single Section) *(3-Section)*

Explanatory Notes

The accompanying illustrations are probably self-explanatory to most service men. However, a few supplementary notes may prove helpful.

The distinct symbols for the two types of ground connections are necessary because they appear on the schematic circuit diagrams of ac-dc receivers (and also in some a-c receivers) wherein the chassis and external ground are not the same.

The symbols for the variable air tuning condenser and the adjustable trimmer are distinguished by size and by the fact that the tuning condenser symbol employs a curved line for the rotor, whereas the adjustable trimmer employs a straight line crossed by the arrow. The lower line is the *rotor* or *grounded* plate, when the arrow points upward, i.e., the tail of the arrow is closest to the *rotor* or *grounded* part of the trimmer. If the rotor is not grounded, the same symbol is used, except that the location of the arrow then identifies the *rotor* plate or plates.

The symbol for a *fixed* condenser remains the same as it has always been. However, a special description of the condenser, when required, may be used. For example, if a compensating or ceramic condenser is used, the word "compensating" or "ceramic" may be written out adjacent to the symbol of the condenser on the schematic.

The most marked change has been made in the symbols used for "wet" and "dry" electrolytic condensers. With the symbols shown here, the service man can tell instantly whether the electrolytic condenser is of the "wet" or "dry" type, how many sections it has, and which sides of the circuit the anode and cathode connect to. If any special description such as "regulating" (for *self-regulating* condensers as against *non-regulating* units) is desired, this word, or its abbreviation, may be placed on the schematic adjacent to the condenser symbol.

The sections of a multi-section unit do not necessarily have to be drawn together as shown here. However, all sections of a multi-section condenser or resistor should have a common code number, and be differentiated by a suffix; and this should be done whether or not the sections are drawn together.

Example: C21a, C21b, C21c
or, 21a, 21b, 21c
or, R17a, R17b, R17c, etc.

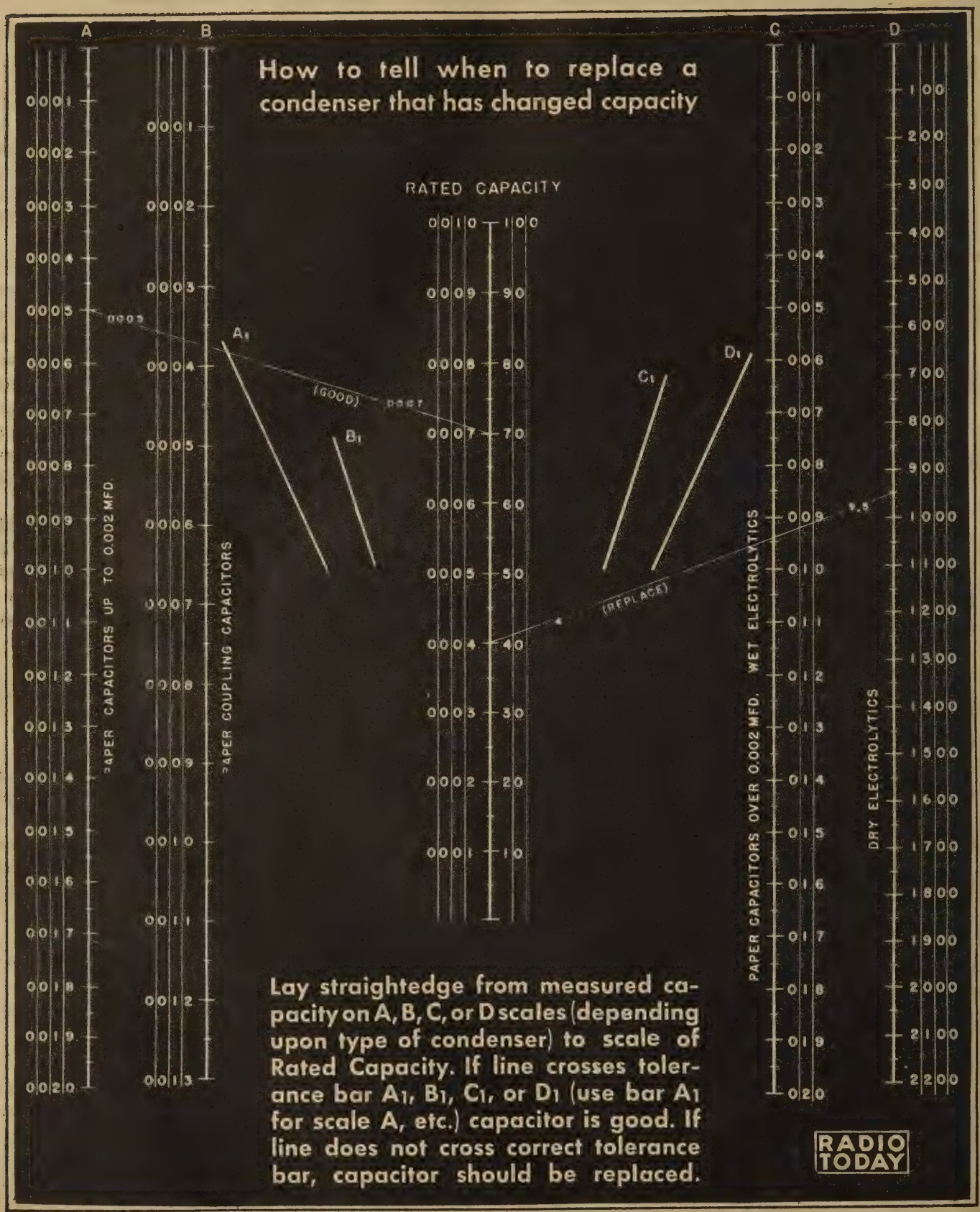
Band Switches

A definite method of illustrating band switches in schematic diagrams has also been proposed. This recommendation is that the switch be shown schematically on the schematic proper. The coil and other component leads are brought out directly to the proper switch terminal. Each switch terminal or lug should be numbered or coded. The individual switch sections can be broken up for convenience in drawing, if desired. Adjacent to this switch or nearby on the drawing is an actual picture or pictorial of the switch leaf. The lugs on the leaf have numbers or are coded in a manner corresponding to the schematic of the switch section.

Sockets

The proposed method of drawing sockets on the schematic is to draw the socket schematically on the schematic with the tube element brought out to the nearest convenient point. In addition to the schematic there is a bottom view drawing of the chassis with each socket in the proper position and the bottom socket terminals shown. Voltages are shown adjacent to each terminal.

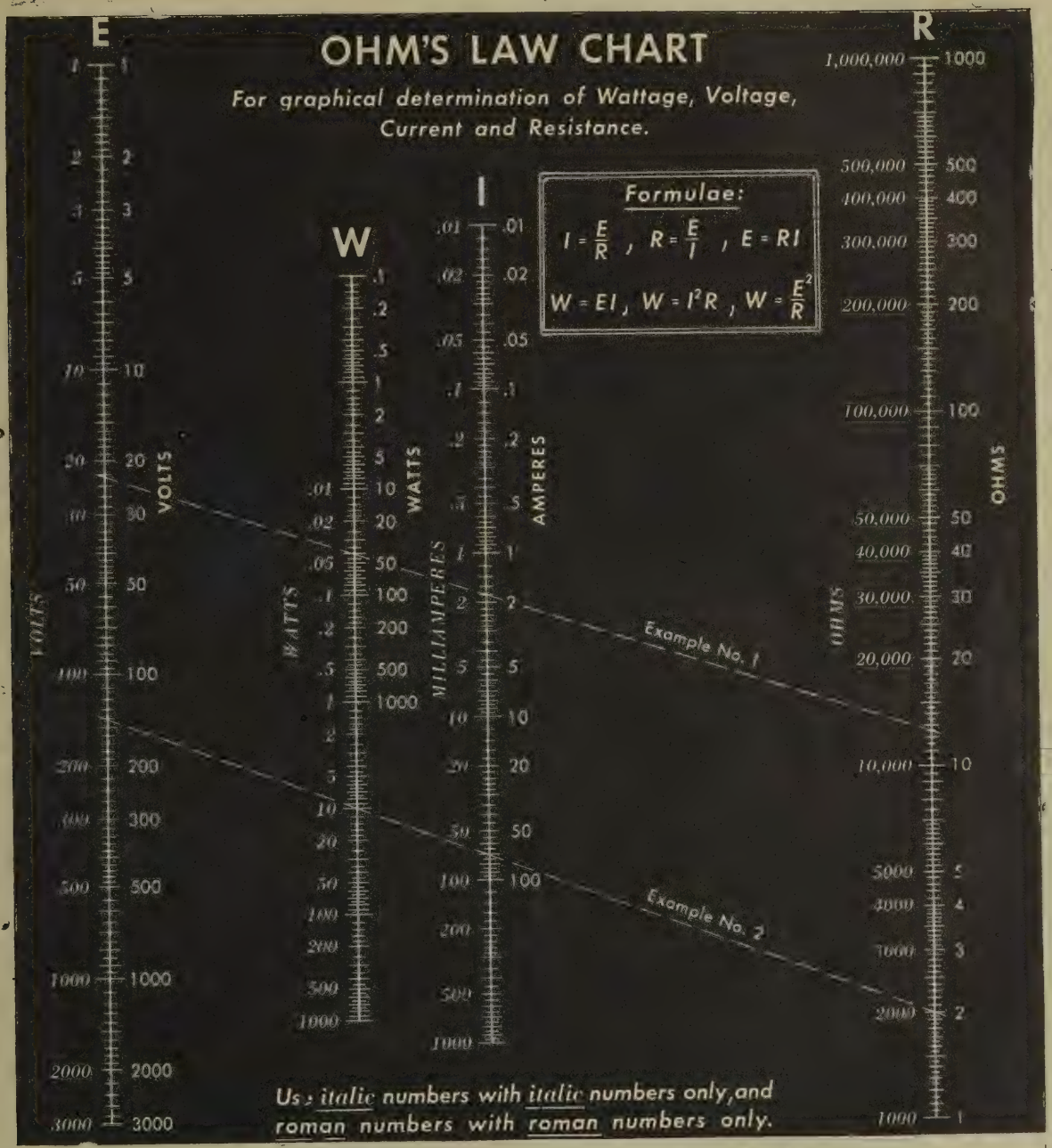
CHART FOR DETERMINING WHEN TO REPLACE A CONDENSER THAT HAS CHANGED CAPACITY


How to tell when to replace a condenser that has changed capacity
A
B
C
D
RATED CAPACITY
A1
B1
C1
D1
(GOOD)
(REPLACE)
PAPER CAPACITORS UP TO 0.002 MFD.
PAPER COUPLING CAPACITORS
PAPER CAPACITORS OVER 0.002 MFD. WET ELECTROLYTICS
DRY ELECTROLYTICS
Lay straightedge from measured capacity on A, B, C, or D scales (depending upon type of condenser) to scale of Rated Capacity. If line crosses tolerance bar A1, B1, C1, or D1 (use bar A1 for scale A, etc.) capacitor is good. If line does not cross correct tolerance bar, capacitor should be replaced.
RADIO TODAY

Reprinted by special permission of "Radio Today"

OHM'S LAW CHART

(For graphical determination of Current, Voltage, Resistance and Wattage in Direct Current Circuits)



Reprinted by special permission "Ohmite Mfg. Co."

How to use this Ohm's Law Chart

This alignment chart enables rapid graphical solution of Ohm's Law problems to be made. To use, place a ruler across any two *known* values on the chart; the points at which the ruler crosses the other scales will show the *unknown* values. The *italic* figures (on the left of the scales) cover one range of values, and the *roman* figures cover another range. For a given problem, *all* values must be read *either wholly* on the italic number scales, or *wholly* on the roman number scales.

Example No. 1: The current through a 12.5 ohm resistor is 1.8 amperes. What is the voltage across it? The wattage?

Answer: Dotted line No. 1 through $R=12.5$ and $I=1.8$ shows E to be 22.5 volts and W to be 40.5 watts.

Example No. 2: What is the maximum permissible current through a 10 watt resistor of 2000 ohms?

Answer: Dotted line No. 2 through $W=10$ and $R=2000$ shows I to be 70 milliamperes.

RESISTANCE—CURRENT—VOLTAGE—POWER-RATING CHART FOR RESISTORS

THE chart shown on the following page has been devised especially to enable rapid determination of the *potential drop* across, the *current* through, or the *power* dissipated in a given resistor to be made when any *two* of these four quantities are known. In addition, it enables one to select a resistor of the correct wattage rating for use under radio chassis operating conditions. The entire chart really represents Ohm's law plotted for the ranges of values commonly encountered in radio work, and it makes it unnecessary to carry out numerical calculations for simple problems involving practical resistor selection and design.

How to Use the Chart

With this chart, it is possible to find any two of the following items—*current, voltage, wattage dissipation, resistance*—if the other two are already known.

Lay a ruler or "straight-edge" across the chart so that it intersects the two scales at the points for which the values are known. The points at which the ruler crosses the other two scales mark the desired values. Do not use a "B" scale with an "A" scale—always employ similar scales—either "A" exclusively or "B" exclusively.

As an example of the method of using the chart, the dotted line which has been drawn on it indicates the following relationships:

On scale "A":

(1) If 100 volts is applied to a resistor of 5000 ohms, then 20 ma. of current will flow. The power dissipated is 2 watts, and a 2-watt composition type resistor may be used.

(2) If a current of 20 ma. is to flow through a resistor when 100 volts is applied across it, the resistor should have a value of 5000 ohms and be a 2-watt unit. It may be of the "composition" type.

(3) If a current of 20 ma. flows through a resistor of 5000 ohms, there will be a potential drop of 100 volts across it. The resistor must be a 2-watt unit. It may be of the "composition" type.

On scale "B":

(1) If 1000 volts is applied to a resistor of 500,000 ohms, then 2 milliamperes of current will flow. The power dissipated is 2 watts, and a 2-watt "composition type" resistor may be used.

(2) If a current of 2 ma. is to flow through a resistor when 1000 volts is applied across it, the resistor should have a value of 500,000 ohms and be a 2-watt unit. It may be a "composition" type unit.

(3) If a current of 2 ma. flows through a resistor of 500,000 ohms, there will be a potential drop of 1000 volts across it. The resistor must have a 2-watt rating and may be the "composition type."

Resistor Wattage Rating

It is standard practice for resistor manufacturers to rate the wattage-dissipation values of their resistors on the basis of the resistors being mounted and operated entirely surrounded by *free air*. As a matter of fact, both the National Electrical Manufacturers Association and the Radio Manufacturers Association have adopted a "standard" for *maximum wattage rating* of resistors of the type commonly used in radio equipment. This is defined as:—

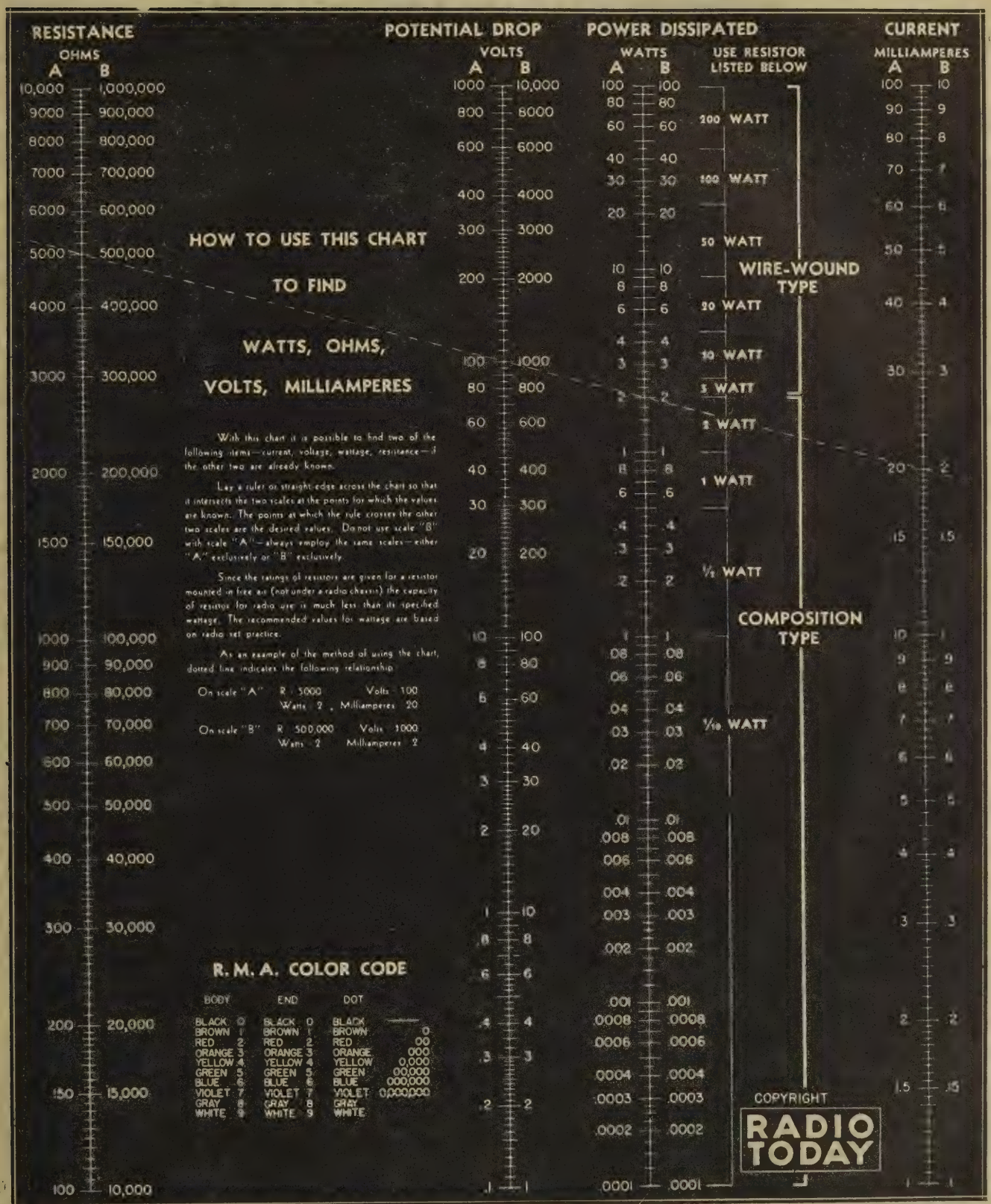
> *the input in watts needed to raise the temperature of the hottest part of the resistor by 250° Centigrade, or 482° Fahrenheit, when it is surrounded by at least a foot of free air, and the surrounding temperature is not over 40° C. or 104° F.*

It is such a "maximum" that is now usually used in labeling resistors. If a resistor is to be used under such good ventilation conditions, well and good, but if, as is usually the case in practice, it is to be placed in a small crowded space (such as under a radio set chassis where ventilation is poor, or the surrounding temperature is high, it cannot dissipate as much electrical power (in the form of *heat*) as this without an abnormal and undesirable rise in operating temperature. Therefore, the use of a resistor having a much higher wattage rating becomes advisable. Therefore, a resistor to be used in a radio receiver should have a larger wattage rating than will be indicated here by the scale headed *"WATTS"*. The recommended values for radio set practice are listed in the adjoining scale headed *"USE RESISTOR LISTED BELOW"*.

Limitations of Chart

Obviously, this chart is of value only when the quantities involved fall within the ranges of the scales; for values beyond these limits it is best to resort to numerical calculations, using the conventional Ohm's law formulas for resistance calculations and the formula $W=E\times I$, $W=I^2R$, for power calculations. Then, too, this chart is suitable only when "approximate" results are desired. Of course, the accuracy with which values may be found by means of this chart depends upon how accurately the ruler is placed at the exact points on the scales, and the accuracy with which the scales themselves are read. It is well for the student or novice to solve a simple problem first by numerical calculation, and then to work it out by means of the chart in order to familiarize himself with the method of using it. He will then have a check on his own computations as well.

(Please see next page for chart)



(See page 648 for explanation of this chart)

Reprinted by special permission of "Radio Today"

"RELATIVE RESISTANCE" & "TEMPERATURE COEFFICIENT OF RESISTANCE" OF 54 COMMON METALS AND RESISTANCE ALLOYS

THE accompanying table lists the resistivity, relative resistance, temperature coefficient of resistance, melting point, and maximum safe working temperature of commonly-used metals and resistance alloys.

"Relative" Resistance

The *relative resistance* (often called *electrical resistivity*) of a material may be defined as:

> *the ratio of the resistance of a wire made of that material to the resistance of an annealed copper wire (ordinary copper wire) of the same diameter and length and at the same temperature.*

For example, if the relative resistance of a material is 20, it means that a piece of this material will have 20 times as much electrical resistance as would a piece of annealed copper of exactly the same dimensions and at the same temperature. If the relative resistance of a material is known, the exact resistance of a wire of certain size made of that material may easily be calculated from data in the accompanying chart and the Magnet Wire Chart in *Section 52* of this Handbook. To illustrate, let us consider the following example:

Example: The resistance of a 50-foot length of No. 14 "Constantan" wire at a temperature of 25 degrees Centigrade is to be found.

Solution: Referring to the Copper Wire Table in *Section 52* of this book we find that the resistance of No. 14 *annealed copper* wire is approximately 2.58 ohms per 1,000 feet (at a temperature of 25 degrees Centigrade). The resistance per foot is therefore 2.58 ÷ 1,000 = 0.00258 ohms. Referring to the "Relative Resistance" column in the data table in this section, we find that the relative resistance of "*Constantan*" wire is 28.3 (i.e., has 28.3 times as much resistance as copper at the same temperature). Therefore, the resistance of a 50-foot length of No. 14 *Constantan* wire at a temperature of 25 degrees Centigrade is equal to 0.00258 × 283 × 50 = 3.65 ohms (approximately) *Ans.*

This calculation illustrates the usefulness of the table of "relative resistance" values when the resistance of wires made of various resistance-alloy materials of a certain gauge number is to be calculated.

Effect of Change of Temperature upon Resistance

The electrical resistance of practically all conducting materials changes with their temperature. The resistance of most metals *increases* with rise of temperature. Such substances are said to have a *positive* temperature coefficient. The resistance of some substances, for example carbon, electrolytes, etc., decreases with rise of temperature. They are said to have a *negative* temperature coefficient. It is found that the law of change in resistance may be expressed approximately as follows:

$$R_2 = R_1 [1 + \alpha_1 (t_2 - t_1)]$$

where R_2 is the resistance of the material at Centigrade temperature t_2, if its resistance at Centigrade starting temperature t_1 is R_1. The temperature coefficient of resistance of the material at starting temp. t_1 *is* α_1. Values of the coefficient for various pure metals and common resistance alloys are given in the accompanying table (for a temperature of 20°C, and also for 100°C).

The temperature coefficient of resistance of a material is defined as *the amount (in ohms) that a one-ohm resistance of the material changes for each °C rise in temperature.* As will be seen from the accompanying table, its value varies somewhat with the temperature.

How to Calculate the Resistance of an Electrical Device at any Operating Temperature

Since the temperature of a conductor may be varied greatly either by its surroundings or by the heat developed within it by the passage of current through it, this effect of increase of the temperature must be taken into account when calculating its resistance if extremely precise results are desired. This is especially important if the conductor is operating at high temperature (as is the case with electric heating elements, vacuum tube filaments, ballast resistors, etc.), since then the total resistance change due to the heating may be appreciable.

The following example illustrates the method of using the temperature coefficient of resistance values tabulated here for calculating the resistance of an electrical device at any operating temperature if its resistance at some other temperature, this may be *room* temperature (20° C. or 68° F.) is known:

Example: A piece of "nichrome" wire whose resistance at the room temperature of 20 degrees Centigrade is 25 ohms, is to be coiled up and used as a heater element. When current is sent through the wire to produce the heat, its temperature rises to 110 degrees Centigrade. What is the (hot) resistance of the wire at this temperature?

Solution: Referring to the accompanying table, we find that the temperature coefficient of resistance of nichrome at 20°C is 0.0004. The resistance at 110°C is, therefore, approximately

$$R_{110} = 25 [1 + 0.0004 (110 - 20)]$$
$$= 25 [1 + 0.0360] = 25 [1.0360] = 25.9 \text{ ohms}$$

Materials which have a "Negative" Coefficient

The temperature coefficient of resistance of alloys is, in general, *less* than that of the metals composing them. Thus, manganin, an alloy of copper, manganese, and nickel has a temperature coefficient which is practically zero at room temperature, and is even *negative* at certain temperatures (see table).

Carbon, electrolytes and some alloys have a *negative* temperature coefficient of resistance. This should be remembered by radio service men in connection with the change of resistance which occurs in molded carbon resistors widely employed in radio receivers. Their resistance *decreases* as the receiver warms up to operating temperature.

The *negative* temperature coefficient of resistance charac-

teristic possessed by some alloys is utilized in devices (such as some electrical indicating instruments) by employing just a sufficient amount in a circuit to neutralize the undesired effect of other material which has a *positive* coefficient, thus keeping the net circuit resistance practically constant over a wide range of operating temperature variation.

For materials for which the temperature coefficient of resistance is *negative* (resistance *decreases* as the temperature is increased), the "hot" resistance will be less than the "cold" resistance by the amount of the resistance changed caused by the change in temperature. The temperature coefficient is employed in resistance-change calculations for such cases in the same way as illustrated in the example just given, but it must be remembered that the calculated resistance change is now a *decrease* when the temperature *increases*, and vice versa.

"RESISTIVITY," "RELATIVE RESISTANCE" AND "TEMPERATURE COEFFICIENT OF RESISTANCE OF 54 COMMON METALS AND RESISTANCE ALLOYS†

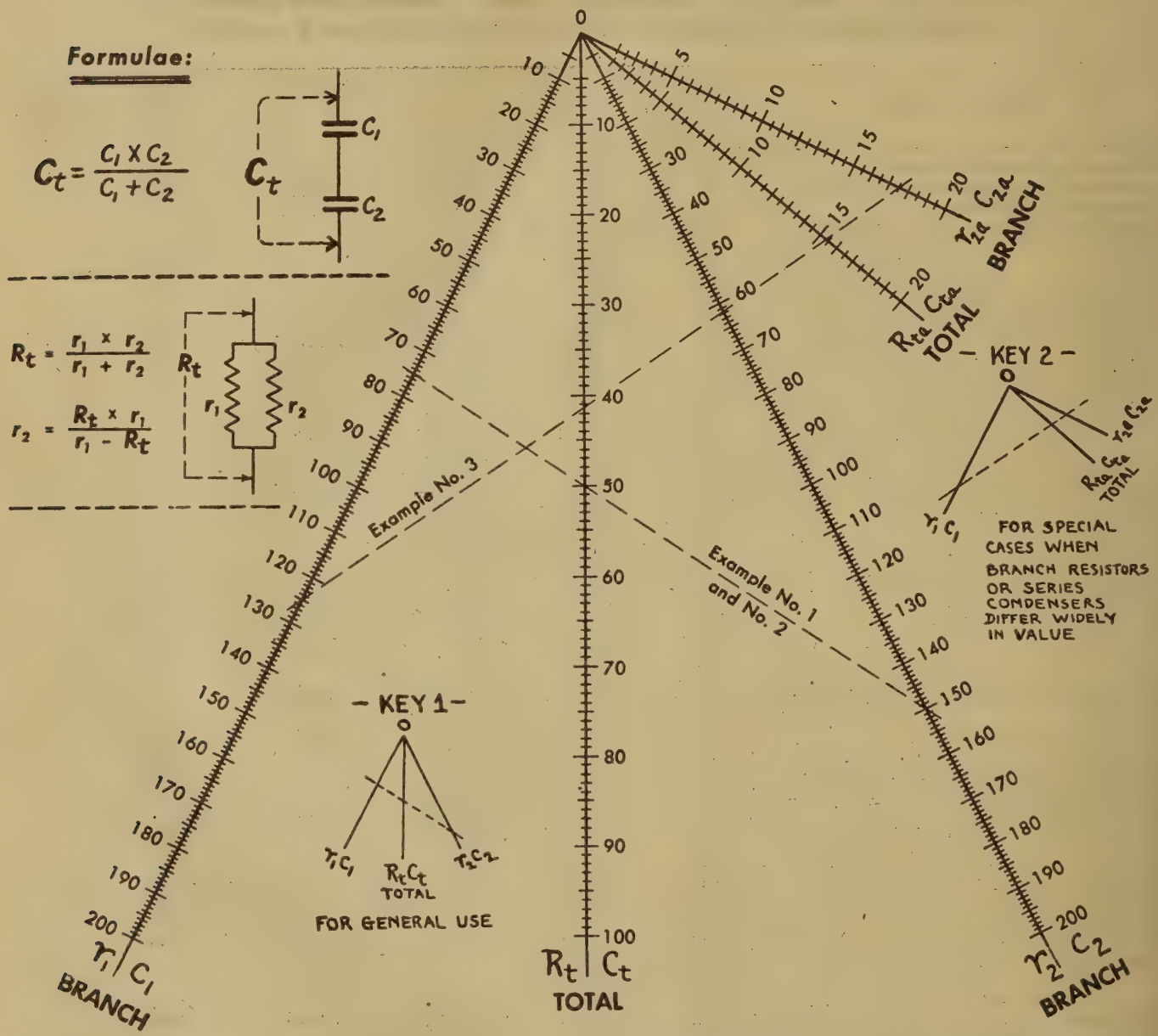
Metal or Alloy	Resistivity at 20°C (*Ohms per circular mil-foot*)	Relative Resistance* (*Annealed Int'l St'd. Copper = 1*)	Temperature Coefficient of Resistance per 1°C‡ at 20°C	Temperature Coefficient of Resistance per 1°C‡ at 100°C	Approximate Melting Point (*Deg. Cent.*)	Maximum Working Temperature (*Deg. Cent.*)
Advance (*Cu 60%, Ni 40%*)	294	28.3	.00001	.000033	1290	500
Aluminum (Hard-drawn conductors)	17	1.64	.0034	.0040	659	———
Ballast wire (*Gilby*)	52	5.0	.05	———	———	———
Berryllium Copper: (*heat treated*)	41.6 to 57.8	4 to 5.55	———	———	———	———
Brass	42.1	4.05	.002	———	900	———
Calido	600	57.7	.0004	———	1500	———
Calorite	723	69.5	———	———	———	———
Carbon (*see also Graphite*)	2,110	203.	—.0005 (neg.)	———	———	———
Chromel A (*Ni 80%, Cr 20%*)	650	62.5	.0000937 (25° to 427°C)		1390	1150
Chromel C (*Ni 60%, Cr 15%, Fe 25%*)	675	65.0	.000157 (25° to 427°C)		1350	1000
Climax	523	50.3	.0007	———	1250	———
Constantan (*Cu 60%, Ni 40%*)	294	28.3	.00001	.000033	1290	500
Copel (*Cu 60%, Ni 40%*)	294	28.3	.00001	.000033	1290	500
Copper: (*Annealed, Intn'l. Standard**)	10.371	1	.00393	———	1085	———
(*Hard drawn*)	10.7	1.03	.00382	.0038	1085	———
(*Pure annealed*)	10.2	.98	.00433	———	1085	———
Cromin D	570	54.8	.00043 (20°C to 100°C)		1415	600
Cupron (*Cu 60%, Ni 40%*)	294	28.3	.00001	.000033	1290	500
Eureka (*Cu 60%, Ni 40%*)	294	28.3	.00001	.000033	1290	500
Everdur (*Cu—Mn—Si*)	156	15.0	.00034	———	———	———
Excello	555	53.3	.00016	———	1500	———
German Silver (*Ni 18%*)	190	18.3	.0004	———	1100	———
Gold (*Pure, drawn*)	14.7	1.41	.0034	.0025	1063	———
Graphite (*see also Carbon*)	4,800	462	———	———	———	———
Ia Ia (*Cu 60%, Ni 40%*)	294	28.3	.0001	.000033	1290	500
Ideal (*Cu 60%, Ni 40%*)	294	28.3	.0001	.000033	1290	500
Iron (*Pure*)	60.2	5.8	.005‡	.0068‡	1575	———
Lead	132	12.7	.0039	———	326	———
Manganin (*Cu 84%, Mn 12%, Ni 4%*)	290	27.9	.00000‡	—.000042‡ (neg.)	910	100
Mercury	576	55.5	.00089	———	—38.9	———
Molybdenum (*Drawn*)	34.3	3.3	.0033	.0034	2500	———
Monel-metal	253	24.4	.002	———	1360	500
Nichrome (*Ni 60%, Cr 15%, Fe 25%*)	600	57.7	.0004‡	———	1500	———
Nichrome II	657	63.2	.00015‡	———	———	———
Nichrome III	540	52.0	.00005‡	.00019‡	———	———
Nichrome IV (*Ni 80%, Cr 20%*)	590	56.8	.00018‡	———	1320	———
Nickel	47	4.5	.0062	———	1452	500
18% Nickel Silver (*German Silver*)	190	18.3	.0004	———	1100	———
Ohmaloy (*15% Cr, 80% Fe, 5% Al*)	750	72.0	.0001	———	1600	850
Phosphor Bronze 5%	45	4.3	.0018	———	750	———
Platinum	60.1	5.78	.003	———	1755	———
Silver (*99.98% pure*)	9.55	0.92	.0038	———	960	———
Steel: (*Soft*)	95.8	9.22	———	———	———	———
(*Hard*)	275	26.4	———	———	———	———
(*Silicon 25%*)	272	26.2	.0008	———	———	———
Tantalum	93.2	8.96	.0031	.00347	2850	———
Therlo	283	27.2	.00001	———	———	———
Tophet A (*Ni—Cr*)	650	62.5	.0001 (20°C to 100°C)		1390	1150
Tophet C (*Ni—Cr—Fe*)	675	65	.00009 (20°C to 100°C)		1350	1000
Topet D	600	57.7	———	———	1400	900
Tungsten (*Drawn*)	33.7	3.24	.0045	———	3000	———
Zinc	38	3.65	.0037	———	419	———
No. 30 Alloy	30	2.88	.00118 (20°C to 100°C)		———	350
No. 60 Alloy	60	5.77	.00046 (20°C to 100°C)		———	350
No. 90 Alloy	90	8.65	.00038 (20°C to 100°C)		———	400
No. 180 Alloy	180	17.3	.00016 (20°C to 100°C)		———	400

*Based on International Annealed Copper Standard of reference in which resistivity of annealed copper = 10.371 ohms per circular mil foot at 20°C, or 1.7241 microhm-centimeters (microhms in a centimeter cube) at 20°C.

†The values given may be used for all ordinary calculations, but it should be remembered that there is considerable variation between alloys produced by different manufacturers. Even small variations in composition will result in considerable variation in properties of many of the resistance alloys.

‡The temperature coefficients of resistance may vary considerably throughout the temperature range, particularly with iron, manganin, nichrome, etc.

PARALLEL RESISTANCES — SERIES CAPACITANCES CALCULATION CHART*



*Reprinted by special permission "Ohmite Mfg. Co."

How to use this Parallel Resistances—Series Capacitances Chart

This alignment chart makes possible the graphical solution of problems involving resistances connected in *parallel*†—or capacitances connected in *series*. The values of the parallel resistors r_1 and r_2 and of the total effective resistance R_t must be read on the scales marked with the corresponding letters. Likewise with the values of series capacities c_1 and c_2 and of the equivalent capacitance C_t. To use, place a ruler across the two known values; the point at which the ruler crosses the third scale will show the unknown value. Pairs of resistances which will produce a given parallel resistance can be obtained by rotating a ruler around the desired

†For parallel resistor and series condenser calculation formulae see upper left-hand corner of this Chart.

value on scale R_t.

The range of the chart can be increased by multiplying the values on *all* the scales by 10, 100, 1000, etc., as required.

Scales r_{2a} and R_{ta} are used with scale r_1 when the values of the parallel resistors r_1 and r_2 differ widely. Likewise, scales c_{2a} and C_{ta} are used with scale c_1 when the values of c_1 and c_2 differ widely.

Example No. 1: What is the total resistance of a 75 ohm resistor and a 150 ohm resistor connected in parallel?

Answer: From dotted line No. 1, R_t is 50 ohms.

Example No. 2: What resistance in parallel with 750 ohms will give a combined value of 500 ohms?

Answer: From dotted line No. 1, r_2 is 1500 ohms.

Example No. 3: What is the combined resistance of 1750 ohms and 12,500 ohms?

Answer: Scales r_1 and r_{2a} are used, and from dotted line No. 3, R_{ta} is 1535 ohms.

Example No. 4: What is the combined resistance of a 400, 600 and 800 ohm resistor in parallel?

Answer: First find R_t for 400 ohms and 600 ohms. Then set the 240 ohms thus found as a new r_1 and 800 ohms as r_2, and the final answer is found to be 185 ohms.

Example No. 5: What is the equivalent capacitance of a 75 mmfd. condenser and a 150 mmfd. condenser connected in series?

Answer: From dotted line No. 1 C_t is found to be 50 mmfd.

Example No. 6: What capacitance in series with 750 mmfd. will give a combined value of 500 mmfd.?

Answer: From dotted line No. 1, c_2 is found to be 1500 mmfd.

Example No. 7: What is the combined capacitance of 1750 mmfd. and 12,500 mmfd.?

Answer: Scales c_1 and c_{2a} are used, and from dotted line No. 3 C_{ta} is found to be 1535 mmfd.

Example No. 8: What is the combined capacitance of a 400, 600 and 800 mmfd. condenser in series?

Answer: First find C_t for 400 mmfd. and 600 mmfd. Then set the 240 mmfd. thus found as a new c_1 and 800 mmfd. as c_2, and the final answer is found to be 185 mmfd.

REACTANCE CHART — REACTANCE OF INDUCTANCES AND CONDENSERS AT FREQUENCIES OF FROM 1 CYCLE TO 1,000 MEGACYCLES

THE necessity for knowing the reactance of a condenser at the commonly used frequencies in radio work arises from time to time, and the service man must usually resort to numerical calculation in order to find it. The formula for the reactance of a condenser is:

$$X_c = \frac{1}{2\pi fC}$$

where X_c is the condenser reactance in ohms, 2π equals 6.28, f is the frequency in cycles per second, and C is the capacity in farads.

Examination of the foregoing formula shows that the reactance of a condenser is *inversely* proportional to the frequency. It is also *inversely* proportional to the capacity. Therefore, if the *frequency* of the voltage applied to the circuit in which a condenser is used is *tripled*, say, the reactance of the condenser is reduced to *one-third* its former value. Likewise, if the capacity of a condenser is *doubled*, its reactance at a given frequency will be reduced to *half* its former value.

As the calculation of capacitive reactance is rather tedious due to the large numbers which are usually involved, the reactances of condensers over a wide range of frequencies may be more quickly found from the accompanying charts.

Likewise for the reactance of an inductance (opposition to the current flow offered by an inductance). The inductive reactance (X_L) is numerically equal to

$$X_L = 2\pi fL$$

where X_L is the inductive reactance in ohms, 2π equals 6.28, f is the *frequency* in cycles per second, and L is the inductance in *henries*.

It is evident from this equation that the *inductive* reactance is *directly* proportional to the frequency and the amount of inductance, i.e., as they are *increased*, the inductive reactance also *increases*. Thus a condenser and an inductance have *opposite* effects on the flow of current in an a-c circuit as the frequency is varied.

Convenience of Using These Reactance Charts

The idea of reactance charts† is not new but the simplifications embodied in the charts on the accompanying pages should make them more useful than those heretofore available. The frequency range covered comprises the frequency spectrum from 1 cycle per second up to 1,000 megacycles per second and all of the scales involved are plotted in actual magnitudes so that no computations are required to determine the location of the decimal point in the final result.

In order to make these conditions possible, the frequency spectrum has been divided into three parts—with a chart for each part:

Chart 1—Covers the range from 1 cycle to 1,000 cycles (1 kc).
Chart 2—from 1 kilocycle to 1,000 kilocycles (1 mc).
Chart 3—from 1 megacycle to 1,000 megacycles.

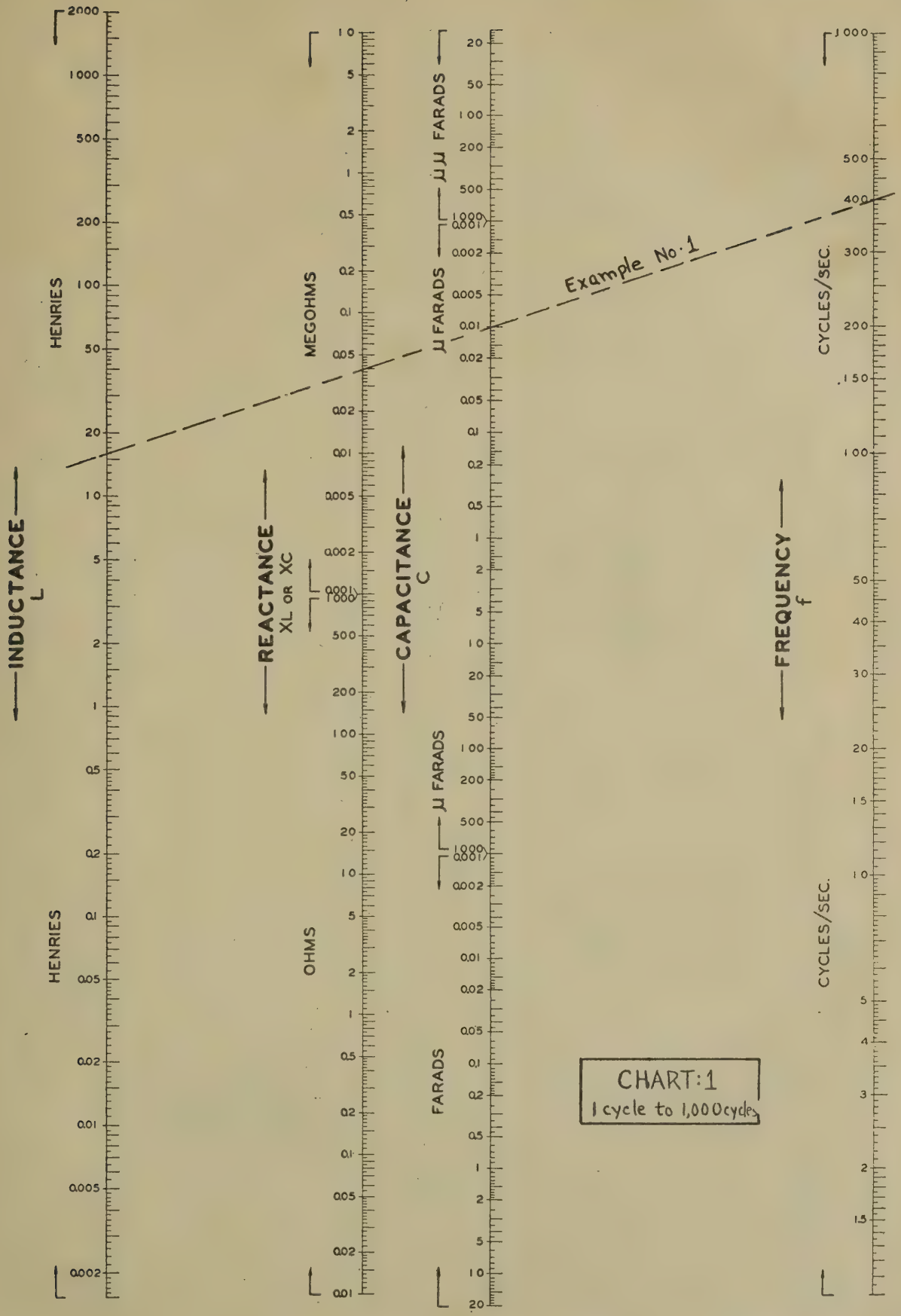
Inductance, capacitance, reactance and frequency have been plotted so that the reactance offered by an inductance or capacitance at any frequency may be readily determined by placing a straight-edge across the proper chart so as to connect the known quantities. Since $X_L = X_C$ at resonance in most radio circuits, the charts may also be used to find the resonant frequency of any combination of L and C.

How To Use the Charts

To illustrate with a simple example, suppose the reactance of a 0.01 mfd. condenser is desired at a frequency of 400 cycles. Place a straight-edge across the proper chart so as to connect the points 0.01 mfd. and 400 cycles per sec. (see Chart 1). The quantity desired is the point of intersection with the reactance scale, which is 0.04 megohms, or 40,000 ohms. The straight-edge also interests the inductance scale at 15.8 henries, indicating that this value of inductance likewise has a reactance of 40,000 ohms at 400 cycles per sec. and furthermore, that a combination consisting of these values of L and C would be in resonance at this frequency.

There are many practical uses for these charts, and the service man should find them helpful in the rapid solution of many reactance problems. Unusual care was exercised in laying out the various scales in order to secure a high degree of accuracy for the charts. Results should be obtainable which are at least as accurate as might be secured if computations were made with a good ten inch slide rule.

†For reactance calculation formulae see *Sections 47 & 67* of this *Handbook*. ***(Please See Charts on three pages following)***



Reprinted by special permission of the Sylvania Electric Products Inc.

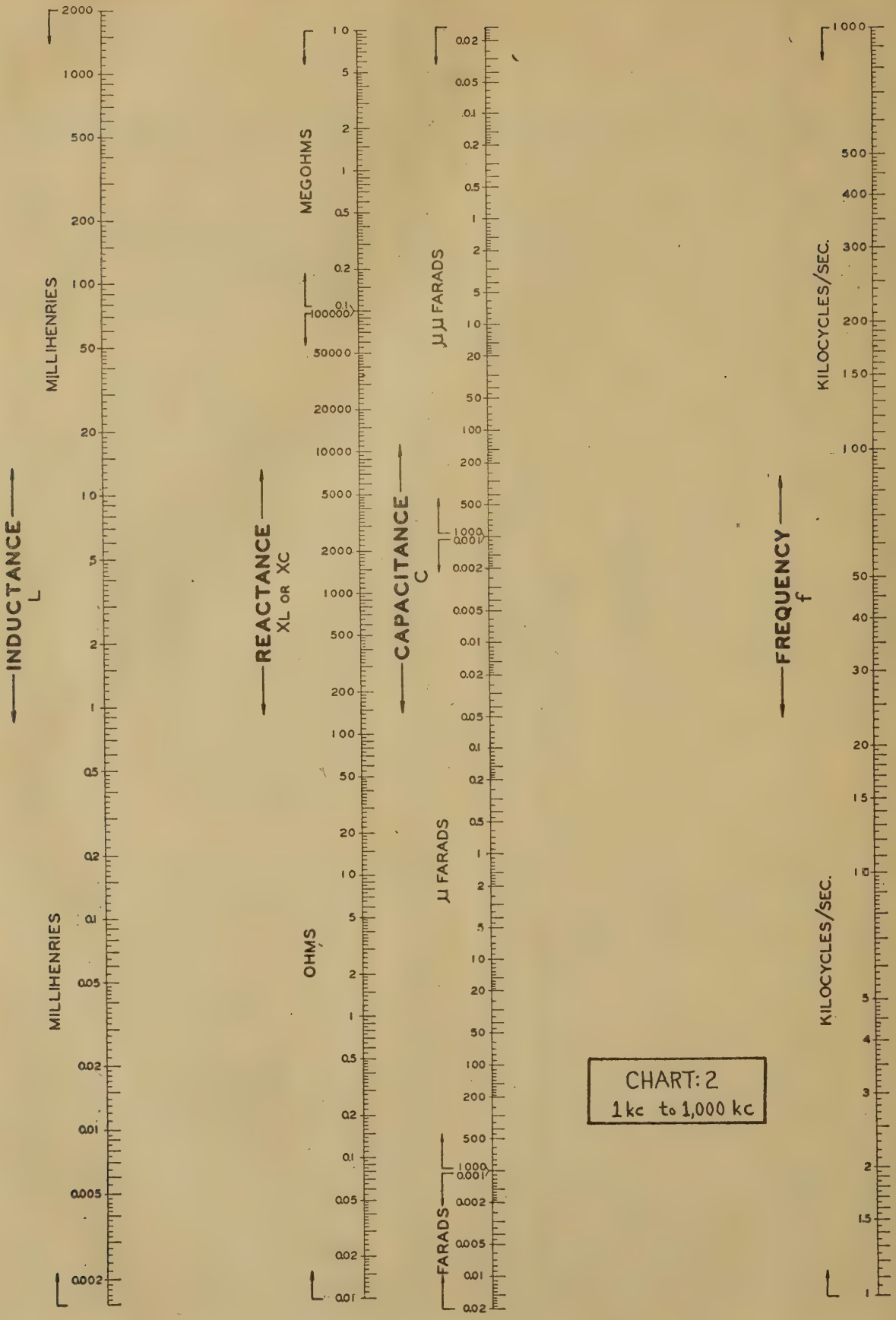
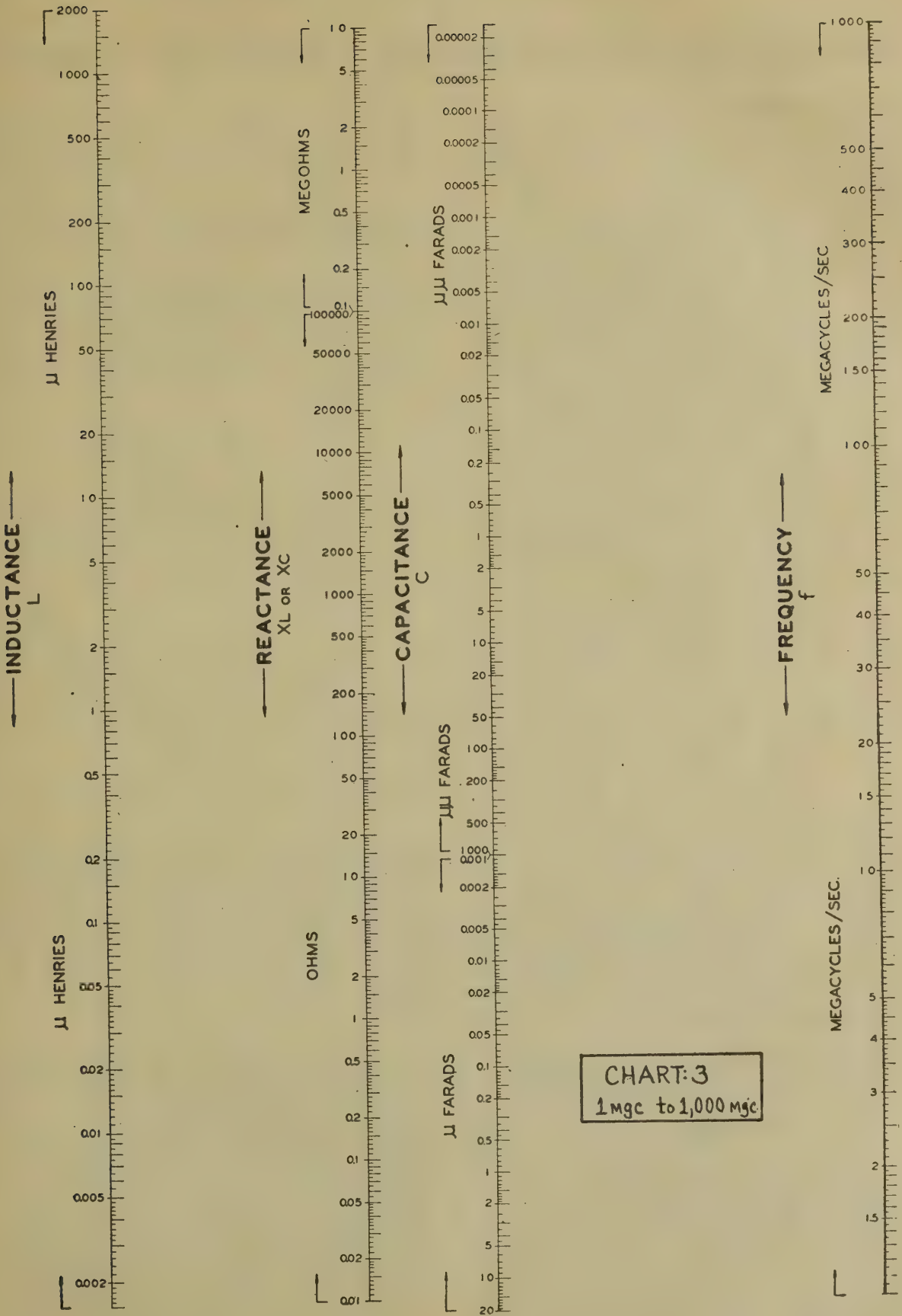


CHART: 2
1 kc to 1,000 kc


INDUCTANCE
L
μ HENRIES
2000
1000
500
200
100
50
20
10
5
2
1
0.5
0.2
0.1
0.05
0.02
0.01
0.005
0.002
μ HENRIES
REACTANCE
XL OR XC
MEGOHMS
10
5
2
1
0.5
0.2
0.1
100000
50000
20000
10000
5000
2000
1000
500
200
100
50
20
10
5
2
1
0.5
0.2
0.1
0.05
0.02
0.01
OHMS
CAPACITANCE
C
μμ FARADS
0.00002
0.00005
0.0001
0.0002
0.0005
0.001
0.002
0.005
0.01
0.02
0.05
0.1
0.2
0.5
1
2
5
10
20
50
100
200
500
1000
0.001
0.002
0.005
0.01
0.02
0.05
0.1
0.2
0.5
1
2
5
10
20
μμ FARADS
μ FARADS
FREQUENCY
f
MEGACYCLES/SEC
1000
500
400
300
200
150
100
50
40
30
20
15
10
5
4
3
2
1.5
MEGACYCLES/SEC.
CHART: 3
1 mgc to 1,000 mgc.

REACTANCE AND RESISTANCE IN SERIES — OR PARALLEL — CHARTS*

THE effects of connecting *resistance* and *inductive* or *capacitive reactance* in parallel or series are not well understood by most service men. Such knowledge is very frequently of great importance in by-pass circuit design, in the design of tone control circuits, frequency cross-over or cut-off networks, etc.

For example, knowing that a condenser connected in parallel with a resistor or an inductance (such as an audio plate load) will by-pass the high notes, how much will the reduction in response be at any given frequency when the values of the resistor (or inductance) and the shunting condenser in a tone control or equalizer are known? What would be the largest allowable capacitance across a resistor so as not to reduce the 8,000 cycle notes more than 10% below the 2000 cycle notes? The charts presented here, plus a knowledge of reactance and impedance formulae and a few simple rules make the solution of such problems a simple matter.

Meaning of the term "Reactance"

Reactance, (X), is the opposition offered by an inductance or a capacitance to the flow of current in an a-c circuit. It is expressed in ohms. In the case of an inductance, the reactance is termed *inductive reactance*, (X_L), and is numerically equal to:

$$X_L = 2\pi fL$$

where:

X_L = the inductive reactance in *ohms*
2π = a numerical constant equal to *6.2832*
f = the frequency in *cycles per second*
L = the inductance in *henries*

It is evident from this equation that the *inductive* reactance (opposition to current flow offered by an inductance) is *directly* proportional to the frequency and to the amount of inductance, i.e., as they are *increased*, the inductive reactance also *increases*.

In the case of a capacitance, the reactance is called *capacitive* reactance (X_C), and is numerically equal to:

$$X_C = \frac{1}{2\pi fC}$$

where:

X_C = the capacitive reactance in *ohms*
2π = a numerical costant equal to *6.2832*
f = the frequency in *cycles per second*
C = the capacitance in *farads*.

It is evident from this equation that the *capacitive* reactance (opposition to current flow offered by a condenser) is *inversely* proportional to the frequency and the amount of capacitance, i.e., as either one is *increased* the capacitive reactance *decreases*. Thus a condenser and an inductance have *opposite* effects on the flow of current in an a-c circuit as the frequency is varied.

Calculation of Reactance and Resistance in Parallel

Where a reactance (the reactance may of course be a condenser or an inductance) is connected in parallel with a resistance, the combined opposition to the current flow in the circuit is called the *impedance* (Z). The impedance of the combination (in *ohms*) is found from the expression:

$$Z = \frac{XR}{\sqrt{R^2 + X^2}}$$

Sometimes Z and R are given and X has to be found, or Z and X are given and R is the unknown quantity to to solved for. In such cases, the equation can be solved for X or R, and we have:

$$X = \frac{ZR}{\sqrt{R^2 - Z^2}} \text{ , or } R = \frac{ZX}{\sqrt{X^2 - Z^2}}$$

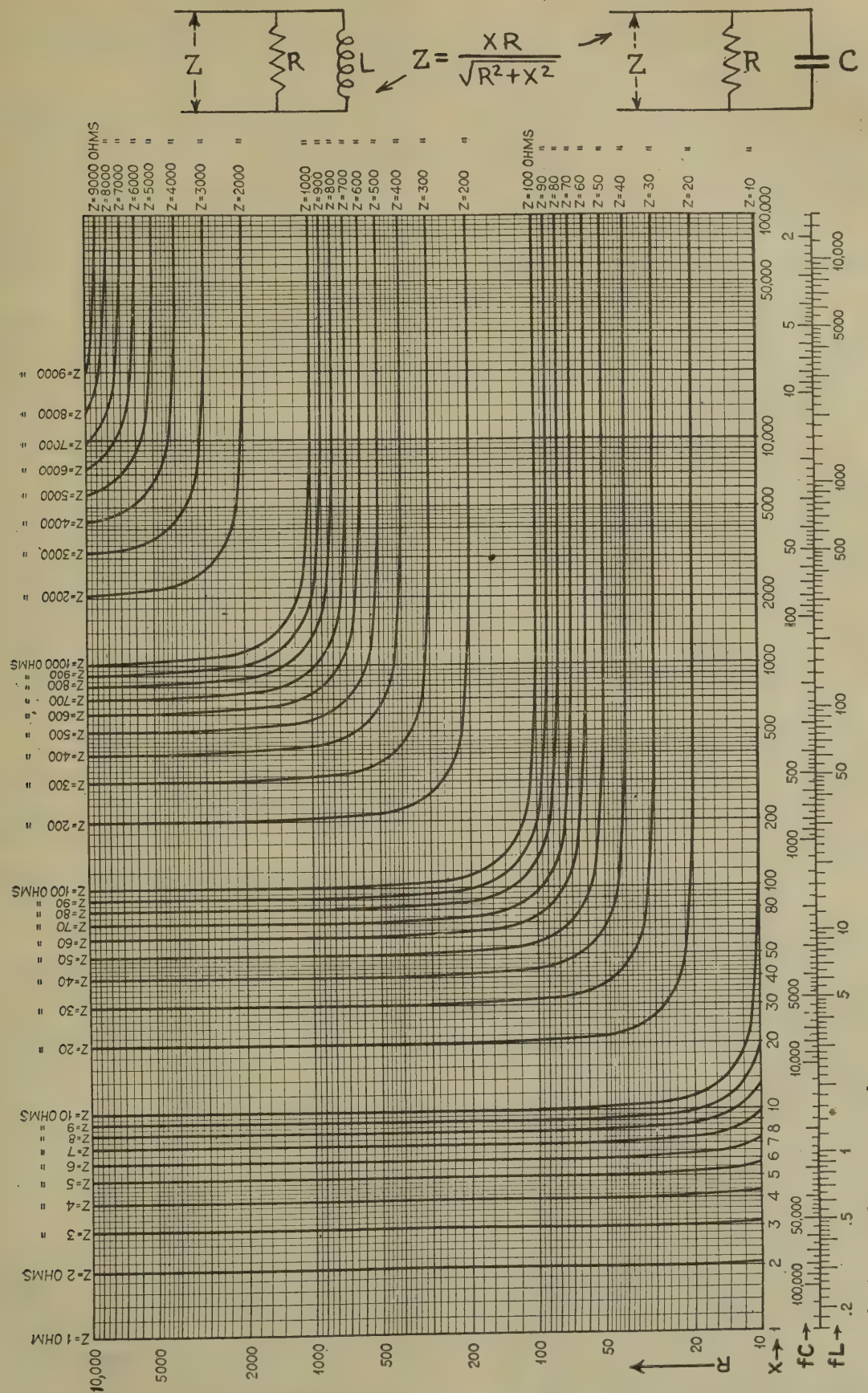
It should be remembered that in all three of the above equations, X can be either *indictive* reactance or *capacitive* reactance (the general term X for reactance is used here to indicate this)

Reactance and Resistance in Parallel Chart

Examination of the three foregoing equations involving the impedance reactance and resistance shows that they are rather cumbersome. The squaring of large numbers, extracting of square roots, etc., is tedious and takes too much time. Hence it is advantageous to be able to find any one of the quantities (X, R or Z) quickly by means of such a chart as is presented in Fig. 47-1.

To make a chart which will solve these equations is not easy, due to the peculiar form of the expressions. Also, most readers would no doubt like to be spared the calculation of X before using the chart. This means that there are three independent variables, which ordinarily cannot be solved in one operation in a two-dimensional medium. So, in order to reduce the number of independent variables to two, X and R are measured along the coordinate axes but alongside the X scale are shown two other scales, which give the corresponding values of fL and fC for each value of X. Since f and C are generally very simple numbers, it will not be difficult to multiply them together mentally before apply-

Fig. 47-1.—REACTANCE AND RESISTANCE IN PARALLEL



*Reprinted by special permission of the "Aerovox Research Worker"

ing them to this scale on the chart in order to find the value of X.

Incidentally, f is in *cycles*, C in *microfarads* and L in *henries* for the scales shown.

Full logarithmic paper has been used because it permits the coverage of a more extended range with the same accuracy everywhere. The range of the chart can be further extended by multiplying Z, X, and R by the same factor. fL would have to be multiplied with the same factor too but fC would have to be divided by it.

How to Use the Resistance and Reactance in Parallel Chart

A few examples of the use of this chart will help to clarify the procedure:

Example 1: A 1000 ohm bias resistor in an audio amplifier is by-passed by a condenser of 8 mfd. What is the resultant impedance between cathode and ground at 100 cycles?

Solution: Obviously, fC is 800; entering the chart at $fC=800$ on the horizontal (fC) axis, follow the vertical line until it intersects with the horizontal line $R=1000$. The point of intersection lies between the curves $Z=100$ and $Z=200$. Estimating the value of Z we obtain 195 ohms. It shows that the condenser is an unsatisfactory by-pass at 100 cycles, and it will be worse at lower frequencies, as can easily be seen from the chart. At 30 cycles there is practically no by-passing effect and the impedance is nearly 1000 ohms.

Note that in this example, X was 199 ohms (which is about one fifth of R) and that Z is but slightly less than X. This will always occur when either one of the quantities X and R is much larger than the other. The reader might memorize the following useful rule:

When one of the two quantities X and R is more than five times as large as the other, the resultant impedance is nearly equal to the smallest of the two qunatities.

The error made in this way is very small: two per cent when the ratio is 5, and one half per cent when the ratio is ten.

Example 2: The capacity across a diode load resistor of 0.5 megohm is 100 mmfd. How much does this decrease the impedance of the load at 5000 cycles?

Solution: In this case fC equals 0.5 and X equals 320,000 ohms. These values are beyond the range of the chart, so divide both R and X by 1000. Locate the intersection of the lines $R=500$ and $X=320$. This is between $Z=200$ and $Z=300$. By estimation: $Z=260$. The answer to the question is then, Z equals 260,000 ohms. The result shows the disastrous effect of having so much capacity across the resistor; it will cut the signal voltage in half at 5000 cycles but not at the lower frequencies.

Example 3: What is the resultant impedance of a 100 henry choke in parallel with a 0.25 megohm resistor at 1000 cycles.

Solution: In this case fL is 100,000 and X is 628,000 ohms. Dividing both R and X by 1000, find the intersection of the lines $R=250$ and $X=628$; Z is then 235. The answer is 235,000 ohms. It is now very simple to find the complete frequency characteristic of the parallel combination. Following the horizontal line $R=250$ it is found that at 500 cycles ($fL=50{,}000$) Z equals 190,000 ohms and at 100 cycles $Z=93000$ ohms, etc.

This type of parallel load is often used in impedance coupled amplifiers. The parallel resistor has the effect of flattening out the frequency characteristic if the values are properly chosen. In the above example the constants are apparently not right. Either the resistor should be smaller or the inductance larger.

The idea is to make X considerably larger than R at low frequencies, in that case Z will be nearly equal to R throughout the range . The d-c resistance however, is equal to that of the choke, thus avoiding the loss in voltage that occurs in resistance-coupled amplifiers.

Example 4: As an example of how the chart can also be used backwards: suppose in the above example the resistance value is retained, how large should the choke be in order that at 100 cycles Z will be 200,000 ohms?

Solution: Dividing all values by 1000 again, follow the horizontal line passing through the point $R=250$ and find its intersection with the line marked $Z=200$, then follow the vertical line downward from this point and read $X=330$. So the reactance of the choke should be 330,000 ohms, fL should be 52,500 and the inductance 525 henries.

Effect of the Power Factor of the Reactance

It should be clear that the foregoing calculations assume the power factor of the reactance to be zero, that is, the reactive branches have no resistance. This is of course not the case with any practical reactance. However the error is surprisingly small when the power factor is no more than 10 per cent, or the Q of the coil not less than 10.

Calculation of Reactance and Resistance in Series

When a resistance is connected in series with a reactance (the reactance of course may be a condenser, an inductance, or a combination of condensers and inductances) the resultant opposition to the current flow is called the *impedance* (Z). The impedance of the combination (in ohms) is found from the expression:

$$Z=\sqrt{R^2+X^2}$$

When Z is given and either X or R is the unknown, the equation can be written:

$$R=\sqrt{Z^2-X^2}, \text{ or } X=\sqrt{Z^2-R^2}$$

In all three equations, X can be either *inductive* reactance or *capacitive* reactance (the "general" term X for reactance is used here to indicate this).

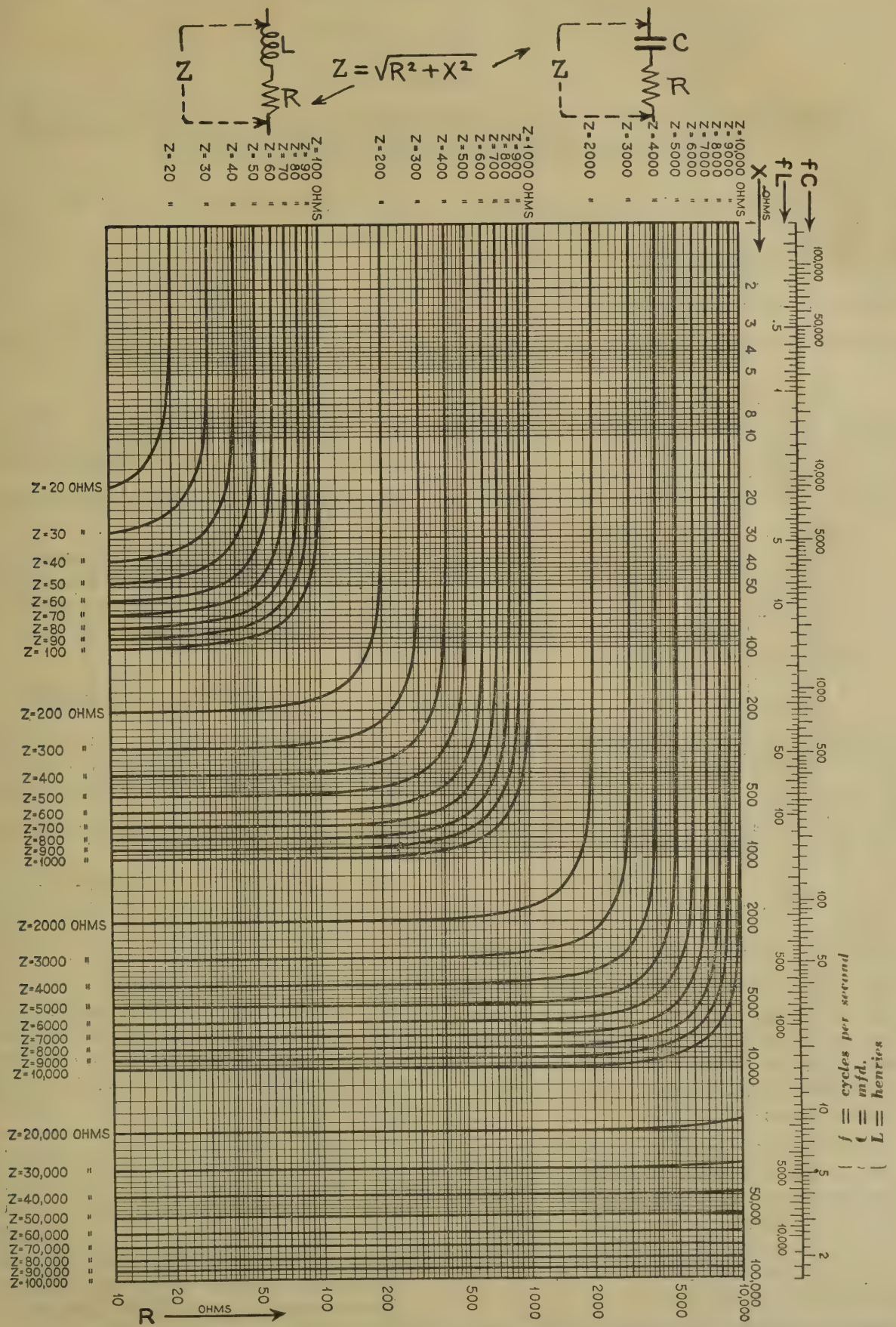
Reactance and Resistance in Series Chart

The accompanying chart (Fig. 47-2) has been prepared to permit rapid finding of any of the three quantities X, R or Z in a series circuit, where the other two are given. It is arranged in the same style as the "Parallel" chart of Fig. 47-1.

To make the calculation of the reactance (X) unnecessary, before using the chart there are two scales which give the corresponding values of fL and fC for each value of X.

Since f and C are generally very simple numbers, it will not be difficult to multiply them together mentally before applying them to this scale on the chart in order to find the value of X. After the value of X is found in this way the chart is used in exactly the same way as already explained for the *"Reactance and Resistance in Parallel"* chart of Fig. 47-1.

Fig. 47-2—REACTANCE AND RESISTANCE IN SERIES



**Reprinted by special permission of the "Aerovox Research Worker"*

"TIME CONSTANT" CHARTS FOR RESISTANCE-CAPACITANCE AND RESISTANCE-INDUCTANCE SERIES CIRCUITS

THE "time constants" of the load and coupling elements in amplifiers, and of the pass or rejection elements in filter networks are important factors in the design work on audio and video radio equipment, and should therefore be thoroughly understood.

"Time Constant" of a Resistance-Capacitance Series Circuit

When a condenser charges through a resistor, the voltage across it does not rise instantaneously but takes a definite time to reach its maximum value—this time, T, depending upon the value of the applied voltage, E, the capacitance, C, and the resistance R. The voltage, e,

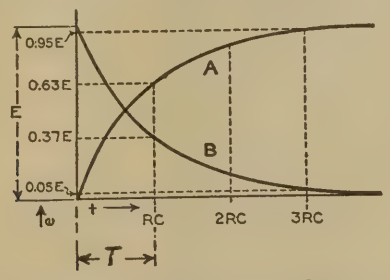


Fig. 48-1.—Graphs showing how the charge and discharge currents, and voltage across the condenser, rise and decay in a resistance-capacitance series circuit.

across the condenser at any instant increases according to the curve A in Fig. 48-1. It can be mathematically expressed by the equation:

$$e = E\left[(1 - e)^{-\frac{T}{RC}}\right]$$

From this equation it is easily seen that when $T = RC$, the exponent $\frac{T}{RC}$ becomes —1, and e becomes 63% of E— that is, the voltage across the condenser has risen (and the current in the circuit has decayed) to approximately 63% of its final value. This particular interval of time T is called the *time constant* of the RC circuit, and we therefore have:

$$T \text{ (seconds)} = R \text{ (ohms)} \times C \text{ (farads)}$$

During each successive interval, the current rise or decay will progress towards its steady state value a "like" percentage of what remains. Thus, at the end of the second, third and fourth intervals the respective values of the current and voltage will be approximately 86.5%, 95.5%, and 98.5% of the final value.

In the case of discharge, the condenser voltage falls according to the curve B, this one being a graph of the function:

$$e = (E\ e)^{-\frac{T}{RC}}$$

If T equals RC, the exponent again is —1 and the condenser is discharged to 37% of its original charge. Therefore in the case of discharge also, the time constant $T = R \times C$

It should be clear that the time elapsed to reach a given voltage in all cases depends upon the values of R and C, as well as upon the charging voltage.

"Time-Constant" of a Resistance-Inductance Series Circuit

A similar reasoning applies to the growth and decay of the current *through*, and voltage *across*, an inductance connected in series with a resistor. The expression for the *time constant* of a resistance-inductance series circuit is:

$$T \text{ (seconds)} = \frac{L \text{ (henries)}}{R \text{ (ohms)}}$$

This equation gives the time T required for the current (and voltage across the inductance) to rise, or decay, to approximately 63% of its final value.

How to Use the Accompanying "Time Constants" Charts

The required series circuit constants to produce a given time delay, or the time delay existing in a circuit having any given CR or LR combination can be calculated of course by the equations just given, but the accompanying charts provide a rapid means for evaluating these quantities when the circuit constants are expressed in the customary practical units encountered in radio work (R in ohms, or megohms; L in microhenries, millihenries or henries; C in micro-microfarads, or microfarads; T in microseconds or seconds).

To facilitate greater accuracy, the chart is furnished in two sections. Each chart contains *resistance, inductance, capacitance, time constant* and *frequency* scales. The *resistance* scales on each are numbered 1 and 2. Scale No. 1 is to be used if the circuit contains an *inductance* in series with the resistor, and Scale No. 2 is to be used if the circuit contains a capacitance instead.

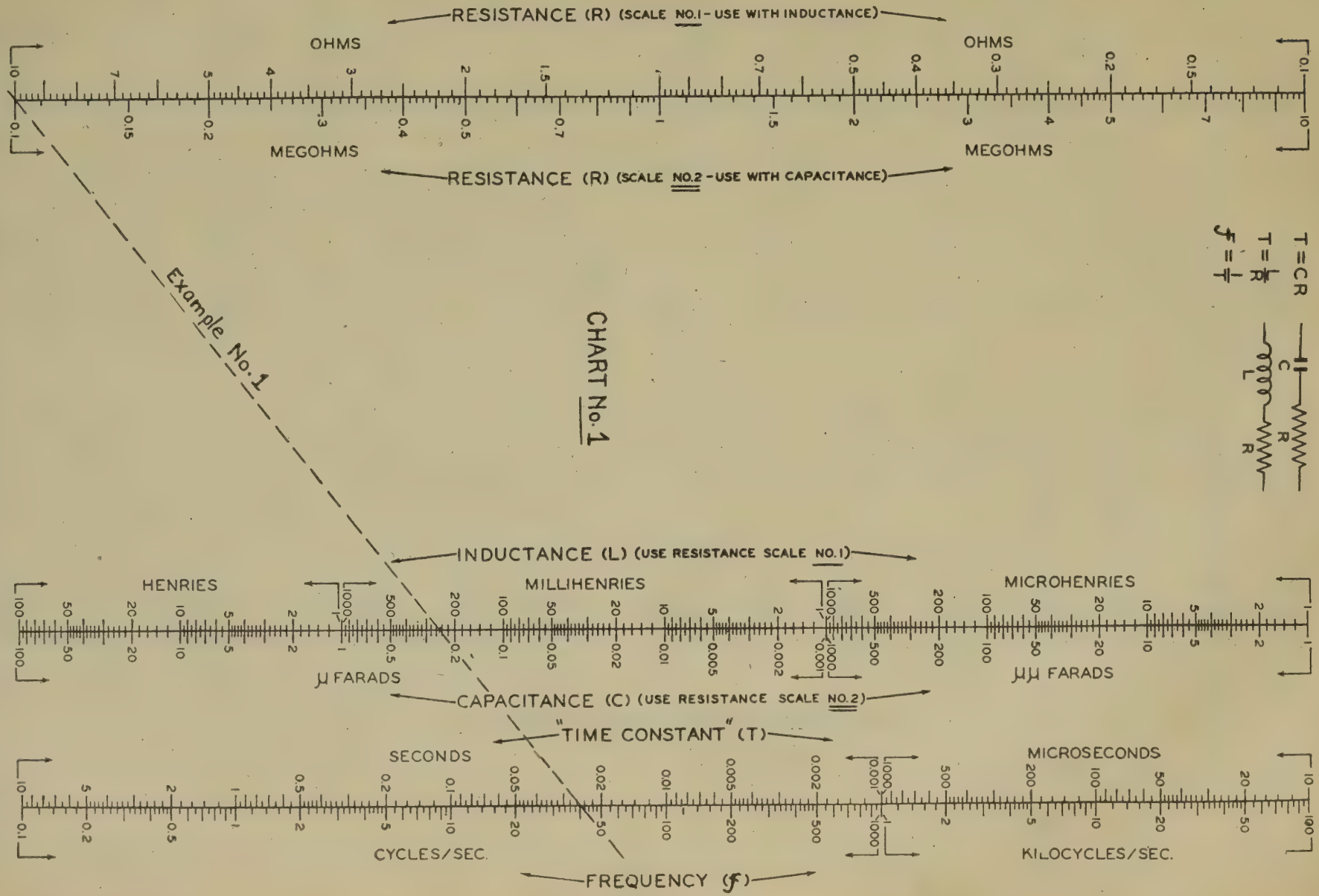
A simple example presented on Chart No. 1 will serve to illustrate how to use these charts.

Example: The time constant of a network consisting of a resistance of 0.1 megohm in series with a capacitance of 0.25 mfd. is desired.

Solution: Lay a straight-edge from the point 0.1 megohm on the *resistance* scale No. 2 (of the first chart) to the point of 0.25 mfd. on the *capacitance* scale. The straight-edge intersects the *time constant* scale at 0.025 second. The *frequency* 40 c.p.s., corresponding to this time constant, represents the highest frequency at which 63.2% of the exciting voltage can be developed across the R-C network in 0.025 second. Thus, higher frequencies would suffer discrimination, particularly as regards amplitude distortion and phase displacement if the wave-form is not sinusoidal.

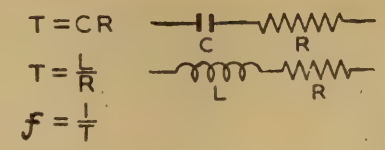
The frequency scales are also useful in determining whether or not an R-C network can follow frequencies impressed across it as, for example, in cases of diode loads with shunting capacitances, or grid leak and condenser combinations.

In a similar manner a straight-edge connecting a given value on *resistance* scale No. 1 with the proper *inductance* value will indicate the correct *time constant* of such a series circuit.



Reprinted by special permission of the Engineering Department of "Sylvania Electric Products Inc."

$T = CR$ $T = \frac{L}{R}$ $f = \frac{1}{T}$



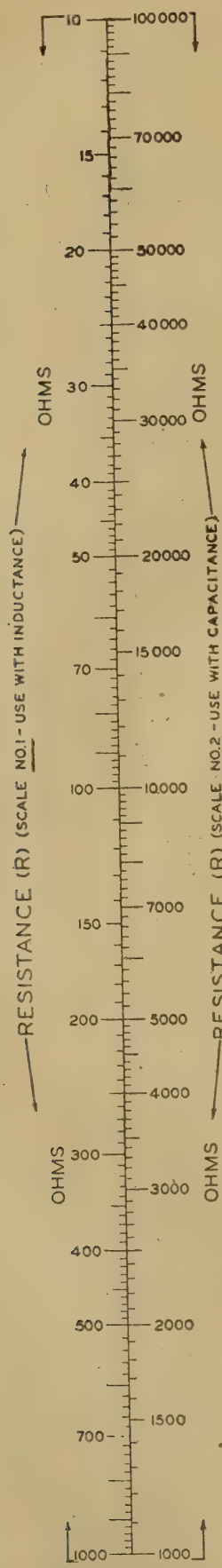
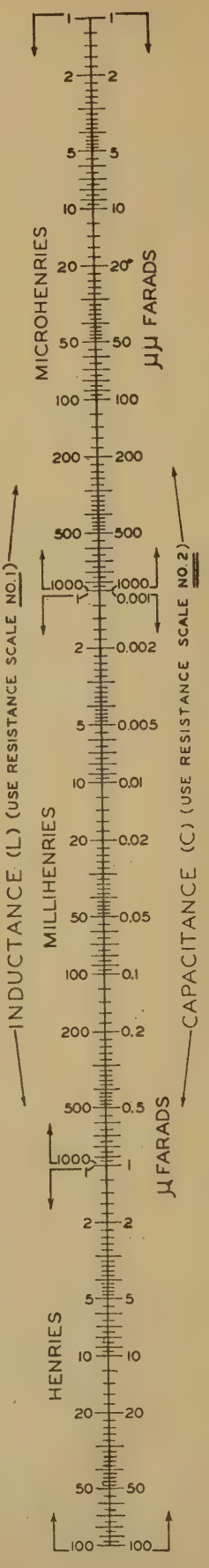
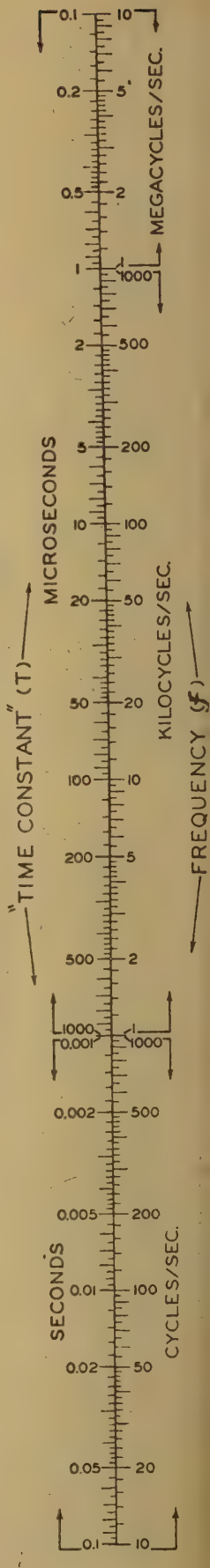


CHART No. 2





VOLUME & TONE CONTROL CIRCUIT ARRANGEMENTS & CORRECT RESISTANCE TAPERS*

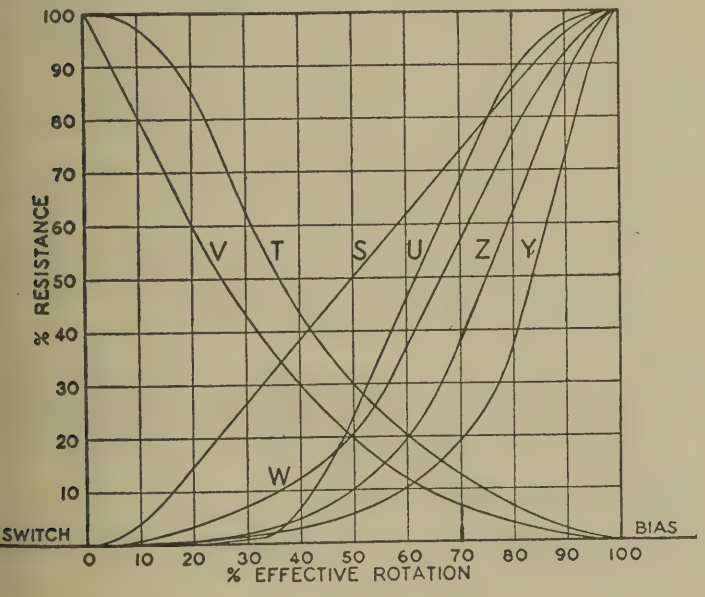
THE use of volume and tone control resistors having suitable "tapered" resistance characteristics (the resistance element purposely designed and constructed so the resistance does *not* vary uniformly for uniform angular rotation of the shaft) has become widespread in radio receivers and sound amplifier equipment, since better control is secured through their use.

The service man should be familiar with the various fundamental volume and tone control circuits employed in this equipment, and the type of resistance taper most suitable for satisfactory control in each.

Of course, when replacing such units, care should be taken not only to use replacements having the correct taper and resistance value for the circuit but also a *smooth* resistance change through out the entire rotation, because a *smooth* resistance change is important for a "noiseless" control.

Various Resistance Tapers Available

The accompanying illustration shows the several standard resistance curves available in the Series "M"



controls of one prominent resistor manufacturer.* Each of the tapers has been designed for specific circuits after exhaustive tests to provide the proper control action necessary in the recommended circuit applications as listed below the illustration. Six of these are absolute tapers (with the "S" being a linear type) for use as voltage divider controls, plate tone controls, and antenna and bias circuits—as specified.

TYPICAL CIRCUIT APPLICATIONS OF THE VARIOUS RESISTANCE TAPER CURVES SHOWN ABOVE ARE:

Type:	*Taper:*	*Application:*
CURVE "V"	RIGHT HAND	"C" Bias Rheostat
CURVE "T"	RIGHT HAND	Ant. & "C" bias control for 1 Tube with Bleeder, or 2 Tubes without Bleeder.
CURVE "U"	LEFT HAND	Ant. & "C" bias control for 1 Tube without Bleeder.
CURVE "W"	LEFT HAND	Screen Grid voltage, phono pickup, regeneration control.
CURVE "Y"	LEFT HAND	Audio Shunt & A. V. C., when steep taper is desired.
CURVE "Z"	LEFT HAND	Audio Shunt, A. V. C., tone, gain control.
CURVE "S"	LINEAR	Standard Potentiometer.
CURVE "L" & "N"	LEFT HAND	Special curves, available only in values listed under Series "C" "M" & "W".

Fundamental Volume & Tone Control Arrangements & Recommended Resistor-Replacements for Each

The thirty fundamental volume and tone control circuits shown here are those which the service man will run across most frequently. Each circuit, and the resistance value and best resistance taper curve (see illustration of various taper curves ahead) to use in it are explained in the accompanying text.

CONTINUED ON FOLLOWING TWO PAGES

**Reprinted by courtesy the Engineering Department of "Clarostat Mfg. Co."*

Circuits No. 1, 2, 3 & 4. Show typical methods of controlling antenna input. This system is not recommended, in that it does not generally provide complete "cut-off" on strong signals.

Suggested replacement—10,000N

Circuit No. 5. Shows the method of controlling volume by varying the plate voltage with a potentiometer.

Suggested replacement—20,000V wire wound due to large currents.

Circut No. 6. Shows the method of controlling volume by varying the plate voltage with a rheostat.

Suggested replacement—75,000V

Circuit No. 7 & No. 8. Shows the method of controlling volume by controlling the R.F. input voltage to the transformer.

Suggested replacement—10,000N

Circuit No. 9. Shows the method of controlling the tube amplification by varying the screen grid voltage.

Suggested replacement—If volume control is part of voltage divider, use duplicate value. If control is across a portion of the voltage divider and original value unknown use 50,000 *ohm. Taper for all cases—"W."*

Circuit No. 10. Shows the method of controlling both the antenna input and the screen grid voltage by means of a dual control. This method is superior to that of Circuit No. 9 and produces less distortion.

Suggested replacement—same as for individual circuit sections.

Circuit No. 11. Shows the method of varying the grid bias by means of a rheostat.

Suggested replacement—"V" tapered controls whose total resistance value duplicates original.

Circuit No. 12. Shows the method of controlling volume by varying grid bias voltage when the volume control is part of the voltage divider. In some cases R1 the minimum biasing resistor is placed at X.

Suggested replacement—"V" tapered controls whose total resistance value duplicates original.

Circuit No. 13. Shows the method of controlling both the antenna input and grid bias by means of a single control. This method is highly recommended.

*Suggested replacement—*10,000 *ohm control with taper as recommended in "Typical Usage" on page* 7.

Circuit No. 14. This method is identical to that shown in Circuit No. 13 except it has a forced bleeder, thus providing a greater voltage change for the same number of controlled tubes.

Suggested replacement—10,000 *ohm control with taper recommended.*

Circuit No. 15. Shows a method of controlling both the antenna input and the grid bias by means of a dual control. This method is identical to that of Circuit No. 13.

Suggested replacement—Single control with same specifications as given under Circuit No. 13.

Circuit No. 16 & No. 17. Shows methods of control gain in audio circuits.

Suggested replacement—500M-Z

Circuit No. 18. Shows the method of controlling audio gain and providing A.V.C. action. Although 2 tubes are shown for simplicity, it also applies to single multi-purpose tubes.

Suggested replacement—500,000Z

Circuit No. 19. Shows the method of controlling audio gain when the A.V.C. action is provided by a separate resistor. This circuit likewise applies to a multi-purpose tube.

Suggested replacement—500,000Z

Circuits No. 20 & No. 21. Show methods of providing tone control in grid circuits.

Suggested replacement—500,000Z

Circuits No. 22 & No. 23. Show methods of providing tone control in plate circuits.

Suggested replacement—30,000S *Wire Wound. Carbon Controls tend to burn out.*

Circuit No. 24. Shows the method of controlling pick-up volume.

Suggested replacement—
For dynamic pick-ups 25,000W
For crystal pick-ups 500,000Z

Circuit No. 25. Shows the method of Automatic Bass Compensation, where a bias cell is used to supply grid voltage to the first audio tube. This system provides the proper Bass response at all volumes.

Suggested replacement—TCP-90

Circuit No. 26. This is a type of tone compensation circuit where increase in Bass response at low volume level is obtained. When the rotor is in the right terminal section of the control the signal is not affected by the resistor and condenser but is fed directly to the grid of the tube. As the rotor starts on the Left Terminal sector of the control, the response is affected by the tap circuit and becomes more effective, the condenser acting as a by-pass for the high frequencies in the signal.

Suggested replacement—TCP of the proper total resistance and with tap of approximately ten or twenty per cent of the total and located at about 50% *rotation.*

Circuit No. 27—This is a very commonly used bias control circuit, where only the cathode is controlled. Taper has low resistance change at maximum volume, and increases in counter-clockwise direction. Used when the current carried may be heavy at maximum volume. Also as a series plate resistor.

Suggested replacement—Proper resistance value with a "V" taper.

Circuit No. 28. Tapped volume control to supply various AVC voltages, used as a diode load resistor.

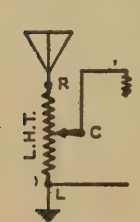
Suggested replacement—TCP with proper resistance value, tap to be located at from 50% to 70% *rotation.*

Circuit No. 29. This is generally known as a double compensating circuit, at full volume there is little compensation but as the volume is reduced there is a noted change at the first tap and a decided response at the second tap.

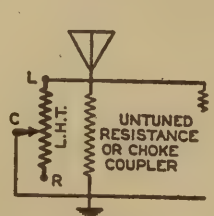
Suggested replacements—TCP 91, 92, 121

Circuit No. 30. This is readily used in P.A. work where two sources of signals or microphones are used, cutting in one as the other is cut out. Also used in radio having phonograph. As the radio signal is reduced the phono circuit is cut into service.

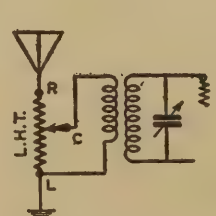
Suggested replacements—TCP 90, 112



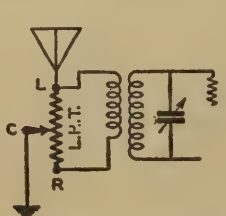
Circuit 1



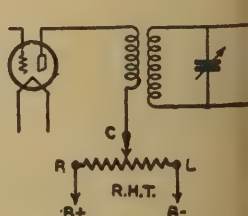
Circuit 2



Circuit 3



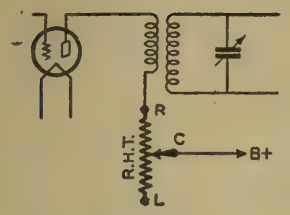
Circuit 4



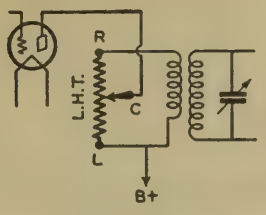
Circuit 5

—(Cont

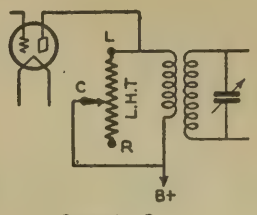
—(*Cont'd*)



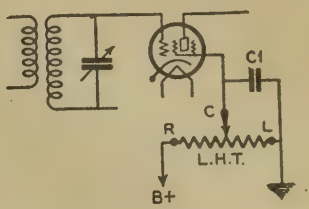
Circuit 6



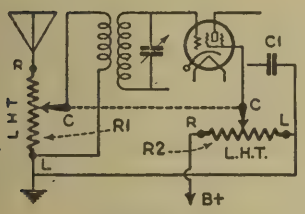
Circuit 7



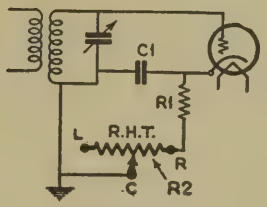
Circuit 8



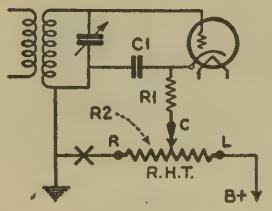
Circuit 9



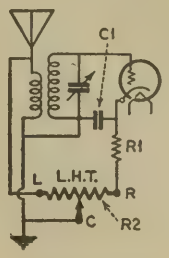
Circuit 10



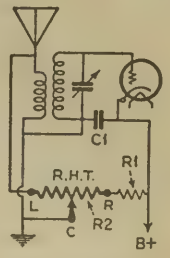
Circuit 11



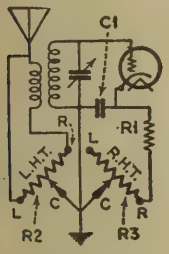
Circuit 12



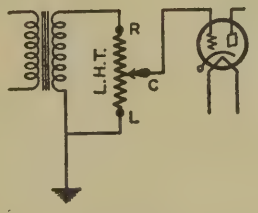
Circuit 13



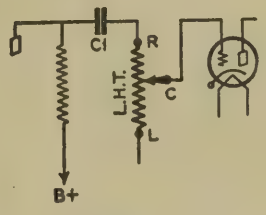
Circuit 14



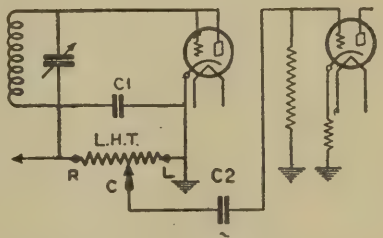
Circuit 15



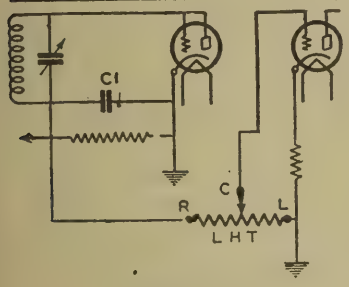
Circuit 16



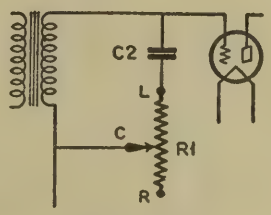
Circuit 17



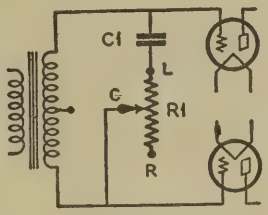
Circuit 18



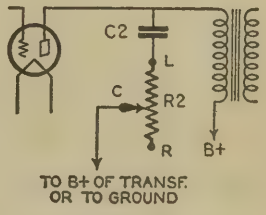
Circuit 19



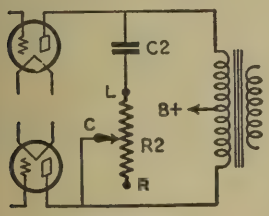
Circuit 20



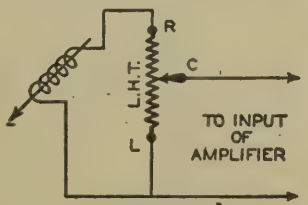
Circuit 21



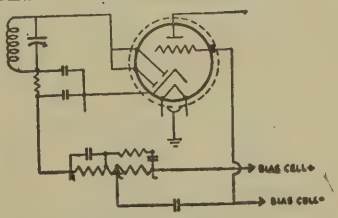
Circuit 22



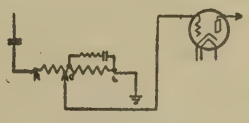
Circuit 23



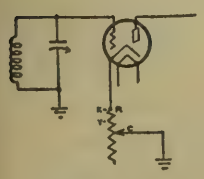
Circuit 24



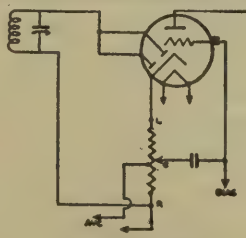
Circuit 25



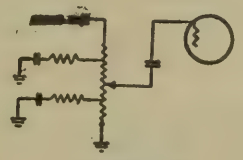
Circuit 26



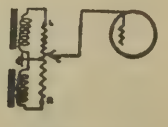
Circuit 27



Circuit 28



Circuit 29



Circuit 30

"LITZ" WIRE SIZE, WEIGHT AND DATA CHART

SINCE higher Q's mean better selectivity and greater "gain", r-f and i-f coils are designed to secure the highest Q compatible with other practical construction and circuit factors. In r-f circuits the inductance of the tuning coil is fixed by the wavelength range to be covered and the size of the variable condenser used. For a given wavelength range and tuning condenser therefore, any increase in Q must be obtained by a reduction of the radio-frequency resistance of the coil.

"Skin-Effect"

The r-f resistance of the coil includes the direct-current resistance (*ohmic* resistance of the copper), and is greater than it because of *skin effect* and because of losses that occur in the coil materials which are located in the rapidly alternating magnetic field of the coil. The skin effect is due to the tendency of the high-frequency alternating current to flow through a comparatively thin shell of the outside surface of the wire rather than uniformly through the whole cross-section area of the copper. Since this thin outside shell has comparatively little cross-section area, it naturally offers a higher resistance to the flow of the current than would be the case if the entire cross-section area of the copper were being utilized. The net result on the resistance offered by the wire to the flow of current through it is precisely the same as though a smaller-size wire were used.*

What "Litz" Wire Is

Now the d-c resistance of a coil winding can be decreased by using larger wire (but such increase is usually restricted by limitations regarding the allowable physical size of the coil). The "skin effect" of a coil winding may be decreased by *increasing* the total surface area of the wire. In order to increase the surface area without also increasing the cross-section of the copper used, the conductor is sub-divided into as many individual strands as is economical and practical, *insulating each strand individually* from the next by a thin enamel coating. Commercial wire in this form is known as "Litzendraht" (commonly called "Litz" wire). Litz wire consists of many strands of fine wire, each strand individually insulated with enamel, and the group of wires covered with some protective textile insulation such as cotton or silk (although sometimes enamel, paper, or other covering is used over the group of wires).

Because the total sum of the cross-section areas of the conducting outer shells of the many individual small conductors in litz wire is *greater* than would be the cross-section area of the larger, thin conducting outer shell of a single solid wire composed of the same total amount of copper, the litz wire has a smaller skin effect (lower "skin resistance") than the solid wire. For this reason, it has greater high-frequency conducting efficiency and is used in r-f coil windings where higher Q's are desired.

Why Individual Strands of Litz Wire Should Be "Twisted"

"Skin-effect" losses in the conductors of which r-f and i-f coils are wound have dictated the use of Litz wire wherever economically possible. However, "skin-effect" goes a step further and requires that the conductor not only be subdivided into a multiplicity of individually insulated strands but that these strands be arranged in such a manner that each occupies a place on the *surface* of the conductor an equal per cent of the time so that the total r-f current will divide equally among the many strands and thereby give the lowest effective r-f resistance. Originally, the strands in Litz wire were braided in a certain manner to give this effect. Because of price, however, modern Litz wire as used in radio receivers is merely twisted so as to bring the different strands to the surface at different points, giving a result approaching that of braided Litz, but at far less expense. Where Litz wire is made without twisting (that is, with parallel strands) the results are inferior to twisted Litz on two counts: (1) the losses are consistently higher than for twisted Litz; (2) coils made of it exhibit greater variations in resistance than coils made from twisted Litz.

Litz Wire Sizes and Weights

The number of strands in the wire varies with the requirements of the application to which the wire is put—mainly the *frequency*. In general, the higher the frequency, the greater is the "skin effect" and therefore the greater the number of strands which should be employed in the litz wire.

The number of possible combinations of number of strands, wire-sizes of individual strands, and various coverings for Litz wire is very large. A few of the more

*Note: For a detailed explanation of *skin effect* in conductors at high frequencies see the *Radio Physics Course* by *Alfred A. Ghirardi.* (Published by the Radio & Technical Division, Murray Hill Books, 232 Madison Ave., New York 16, N. Y.)

commonly-used combinations, and the approximate weight per 1,000 ft. of each, are listed in the accompanying table. These weights will vary somewhat in practice, but will serve for approximate calculations of the amount of wire needed to wind a given quantity of coils. Where the quantities required are sufficient, practically any other desired combination of stranding and covering will be made up by wire manufacturers upon order.

How to Solder Litz Wire

Now that the use of Litz wire has become general both for r-f and i-f coils even in the cheaper radio receivers, it frequently becomes necessary for service men to solder the ends of such coils to terminals, etc. When soldering Litz wire, it is important that good permanent electrical contact be made to *each and every* strand of the wire—otherwise some of the strands will not be conducting their share of the current and consequently the r-f resistance of the coil will increase greatly.

It is evident, of course, that the insulating enamel must first be cleaned off the end of each and every one of the fine strands of the Litz wire—without breaking any of them—before attempting to apply solder. This is apt to be very laborious and time-consuming work if an attempt is made to scrape each strand individually with sandpaper, or a knife. A much simpler and quicker way—the one used in radio mass production—is to hold the end of the wire for a second or two in the flame of an alcohol lamp and dip it, red hot, straight into a bath of alcohol. This operation completely removes the enamel insulation from the individual strands, baring the ends and leaving them so clean that they may easily be soldered.

LITZ WIRE TABLE *

No. of Strands	Size of each strand (Awg, or B. & S. Gauge)	Weight in Pounds per 1000 Feet			
		SCC	DCC	SSC	DSC
10	38	.54	.59	.50	.53
9	38	.49	.54	.45	.48
8	38	.43	.48	.40	.42
7	38	.38	.43	.35	.37
6	38	.33	.37	.30	.32
5	38	.28	.32	.25	.27
10	40	.35	.40	.33	.35
9	40	.32	.37	.29	.31
8	40	.29	.33	.26	.28
7	40	.26	.30	.23	.25
6	40	.22	.27	.20	.22
5	40	.19	.23	.17	.18
3	40	.12	.15	.11	.10
10	41	.29	.33	.26	.28
9	41	.26	.31	.24	.26
8	41	.24	.28	.21	.23
7	41	.21	.26	.19	.20
6	41	.18	.22	.16	.18
5	41	.16	.19	.13	.15
3	41	.10	.14	.08	.09
10	42	.24	.28	.21	.23
9	42	.22	.26	.20	.21
8	42	.19	.23	.17	.19
7	42	.17	.21	.15	.17
6	42	.15	.18	.13	.15
5	42	.13	.16	.11	.12

Key: SCC = single-cotton covered
DCC = double-cotton covered
SSC = single-silk covered
DSC = double silk covered

**Reprinted by courtesy the Engineering Department "Anaconda Wire & Cable Co."*

COMPARISON OF VARIOUS STANDARD WIRE & SHEET METAL GAUGES

WIRES having a diameter less than ½ inch usually have their sizes stated in terms of certain arbitrary scales called "gauges." The size or gauge number of a *solid* wire refers to the cross-section of the wire perpendicular to its length; the size or gauge number of a *stranded* wire refers to the total cross-section of the constituent wires, irrespective of the pitch of the spiraling. Wires larger than ½ inch in diameter are usually described in terms of their area expressed in circular mils instead; for example, a 500,000 circular mil cable, etc.

A circular mil is the area of a circle 1 mil (0.001-inch) in diameter. The area of any circle in circular mils is equal to the square of its diameter in mils. Thus, No. 27 B&S. gauge wire (which has a diameter of 0.0142 inches, or $0.0142 \times 1{,}000 = 14.2$ mils) has a cross-sectional area of $14.2 \times 14.2 = 201.6$ C.M. (circular mils). See table in *Sect. 52.*

Unfortunately there are several systems of wire gauges in use throughout the world. The principle ones, and the basis upon which each is founded, will be described here. A comparison between them may be obtained from the table on page 671. This also lists the U. S. Standard gauge for sheet and plate iron and steel.

The American, or B. & S., Wire Gauge

This is the gauge of primary interest to electrical and radio men in the U. S. A., for it is the one commonly used in the United States for copper, aluminum and resistance alloy conductors employed in power work, radio wiring, telephone control wiring and outside plant cables. It is commonly designated by either of the abbreviations *A.W.G.* or *B.&S.* since it is the wire gauge commonly used in *America* and it was devised in 1857 by J. R. Brown one of the founders of the *Brown & Sharpe* Manufacturing Co.

In the *A.W.G.* or *B.&S.* gauge the diameters of wires having successive numbers on the gauge form a geometrical progression between the limits of a small size wire (No. 36) and a large size wire (No. 0000) whose diameters are fixed by definition. They represent the wire sizes produced as the copper is successively drawn through smaller and smaller dies during the process of the "wire drawing" when manufacturing wire.

By definition, the diameter of No. 0000 wire is 0.4600", and that of No. 36 wire is 0.0050". There are 38 successive wire-drawing reductions required to produce a No. 36 copper wire from a No. 0000 wire. Hence there are 38 sizes in the gauge, between these two. Therefore, since they are in geometrical progression, the diameter of wires having successive numbers on the gauge are in the ratio of:

$$\sqrt[39]{\frac{.4600}{.0050}} = \sqrt[39]{92} = 1.122932$$

This geometrical progression may be expressed as:

"The ratio of the diameter of any gauge number to that of the next smaller gauge number is a constant number (1.122932)."

"The difference between any two successive diameters is a constant per cent of the smaller of the two diameters."

Thus, since the diameter of No. 36 *A.W.G.* wire is 5 mils, No. 35 *A.W.G.* has a diameter of $5 \times 1.122932 = 5.615$ mils, etc.

Interesting Relations Between the Properties of the Various Gauge Numbers in the B. & S. Wire Gauge

Since the *A.W.G.* or *B.&S.* gauge is based on the definite mathematical law of geometric progression, there are certain approximate relations which exist between the properties of the various gauge numbers. It is frequently advantageous to remember them.

The square of the ratio of one diameter to the next is $1.1229322^2 = 1.2610$, which may be conveniently remembered as approximately 1¼. Therefore the resistance in ohms per 1000 feet of any next greater gauge number is approximately 1¼ times that of the smaller gauge number. Consequently:

(1) An increase of 1 in the gauge number *decreases* mass and cross-section, and *increases* the resistance, about *25%*.

(2) An increase of 2 in the gauge number *decreases* mass and cross-section, and *increases* the resistance, about *60%*.

(3) An increase of 3 in the gauge number *decreases* mass and cross-section, and *increases* the resistance, about *100%*.

(4) An increase of 10 in the gauge number *decreases* mass and cross-section, and *increases* the resistance, about *10 times*.

(5) The diameter is very nearly *doubled* (or *halved*) every 6 gauge numbers.

Other Standard Gauges

Several other standard gauges are in use for wire and for sheet and plate metals both in the U.S.A. and other countries. These will now be reviewed briefly here. A comparison table of them appears on the next page.

Birmingham (or Stubs' Iron) Wire Gauge

This gauge is still used in the United States for some purposes (such as to designate the size of brass wire, and to designate the size of copper wire used in long distance open-wire telephone lines), and also to a limited extent in Great Britain. It is generally abbreviated *B.W.G.* It is sometimes referred to as the "Stubs' Iron Wire Gauge," but it should

ot be confused with the Stubs' Steel Wire Gauge (see ccompanying gauge comparison chart).

Vashburn and Moen, Roebling, or Amer. Steel & Wire Co. Gauge

This gauge, known in various trades under any of the hree names above, is the one usually employed in the United States for *steel* and *iron* wire. It is frequently (though ncorrectly) abbreviated "*S.W.G.*," but to avoid confusion vith the English Standard Wire Gauge (described below) t should be abbreviated "*stl. W.G.*," or "*A (steel) W.G.*"

English, British, or Imperial Standard Wire Gauge

This gauge, usually called simply the "*Standard Wire Gauge*," and abbreviated "*S.W.G.*," is also known as the "*British Standard Wire Gauge*" ("*B.S.W.G.*"), or the *Imperial Wire Gauge*. It is the legal standard of Great Britain for all wires. It was constructed by modifying the Birmingham Wire Gauge, so that the differences between successive diameters were the same for short ranges, i.e., so that a graph representing the diameters consists of a series of a few straight lines.

Stubs' Steel Wire Gauge

Wire sizes have been specified in terms of the "*Old English Wire Gauge*," known also as the "*London Gauge*," and the "*Stubs' Steel Wire Gauge.*" The Old English Wire Gauge is the same as the B.W.G. for all gauge numbers under 20.

U. S. Standard Gauge for Sheet and Plate Iron and Steel

This is a gauge designed especially for expressing the thickness of sheet and plate iron and steel in the United States.

Metric Wire Gauge

In this, the gauge number is 10 times the wire diameter in millimeters.

Comparison of the Various Gauges

A comparison of the different gauges, in terms of the dimensions (in decimal parts of an inch) corresponding to each gauge number is represented in the accompanying table.

Expressing the Dimension in Mils

It is frequently necessary or convenient to express in *mils* the dimension represented by the particular gauge number under consideration. The *mils* is equal to the number of *thousandths* of an inch in the dimension.

Thus, from the accompanying table we see that the diameter of No. 10 *B.&S.* gauge wire is 0.10189 inch. This may be expressed, therefore, as 101.89 *mils*. Similarly, the thickness of No. 22 U. S. Standard gauge sheet steel is 0.03125 inches. This may be expressed as 31.25 *mils*.

COMPARISON OF VARIOUS STANDARD WIRE & SHEET METAL GAUGES

(All dimensions are in decimal parts of an inch)

Gauge No.	*American, or Brown & Sharpe Co. (B. & S.)*	*Birmingham, or Stubs' Iron Wire (B.W.G.)*	*Washburn & Moen Mfg. Co., or Roebling (stl.W.G.)*	*British (Imperial) (S.W.G.)*	*Stubs' Steel Wire*	*U.S. Standard gauge for sheet and plate iron and steel*	Gauge No.
0000000	———	———	0.4900	0.500	———	0.500	0000000
000000	.....	.....	.....	0.464	.....	0.46875	000000
00000	.....	.....	.....	.432	.....	.4375	00000
0000	0.46	.4540	0.3938	.400	.....	.40625	0000
000	.40964	.425	.3625	.372	.....	.375	000
00	.3648	.38	.3310	.348	.....	.34375	00
0	.32486	.34	.3065	.324	.....	.3125	0
1	.2893	.3	.2830	.300	.0227	.28125	1
2	.25763	.284	.2625	.276	.219	.265625	2
3	.22942	.259	.2437	.252	.212	.25	3
4	.20431	.238	.2253	.232	.207	.234375	4
5	.18194	.22	.2070	.212	.204	.21875	5
6	.16202	.203	.1920	.192	.201	.203135	6
7	.14428	.18	.1770	.176	.199	.1875	7
8	.12849	.165	.1620	.160	.197	.171875	8
9	.11443	.148	.1483	.144	.194	.15625	9
10	.10189	.134	.1350	.128	.191	.140625	10
11	.090742	.12	.1205	.116	.188	.125	11
12	.080808	.109	1055	.104	.185	.109375	12
13	.071961	.095	.0915	.092	.182	.09375	13
14	.064084	.083	.0800	.080	.180	.078125	14
15	.057068	.072	.0720	.072	.178	.0703125	15
16	.05082	.065	.0625	.064	.175	.0625	16
17	.045257	.058	.0540	.056	.172	.05625	17
18	.040303	.049	.0475	.048	.168	.05	18
19	.03589	.042	.0410	.040	.164	.04375	19
20	.031961	.035	.0348	.036	.161	.0375	20
21	.028462	.032	.03175	.032	.157	.034375	21
22	.025347	.028	.0286	.028	.155	.03125	22
23	.022571	.025	.0258	.024	.153	.028125	23
24	.0201	.022	.0230	.022	.151	.025	24
25	.0179	.02	.0204	.020	.148	.021875	25
26	.01594	.018	.0181	.018	.146	.01875	26
27	.014195	.016	.0173	.0164	.143	.0171875	27
28	.012641	.014	.0162	.0149	.139	.015625	28
29	.011257	.013	.0150	.0136	.134	.0140625	29
30	.010025	.012	.0140	.0124	.127	.0125	30
31	.008928	.01	.0132	.0016	.120	.0109375	31
32	.00795	.009	.0123	.0108	.115	.01015625	32
33	.00708	.008	.0118	.0100	.112	.009375	33
34	.006304	.007	.0104	.0092	.110	.00859375	34
35	.005614	.005	.0095	.0084	.108	.0078125	35
36	.005	.004	.0090	.0076	.106	.00703125	36
37	.004453	———	.0085	.0068	.103	.006640623	37
38	.003965	———	.0080	.0060	.101	.00625	38
39	.003531	———	.0075	.0052	.099	———	39
40	.003144	———	.0070	.0048	.097	———	40
41	.002800	———	.0066	.0044	———	———	41
42	.002494	———	.0062	.0040	———	———	42
43	.002221	———	.0060	.0036	———	———	43
44	.001978	———	.0058	.0032	———	———	44
45	.001761	———	.0055	.0028	———	———	45
46	.001568	———	.0052	.0024	———	———	46
47	.001397	———	.0050	.0020	———	———	47
48	.001244	———	.0048	.0016	———	———	48
49	.001108	———	.0046	.0012	———	———	49
50	.0009863	———	.0044	.0010	———	———	50

BARE & INSULATED COPPER WIRE DATA TABLE

THE following table is a compilation of data on all commonly used sizes of round copper wire in both bare form and those insulated forms which are employed extensively for coil windings of all sorts in radio equipment. This tabulation should prove helpful to radio service men for reference purposes. Several subjects of importance in connection with the data tabulated in several columns of this table will now be explained.

Resistance Data in Table

The resistance of a given length of magnet wire (of specified gauge number) is an important quantity in the design of most apparatus in which magnet wire is used. In this magnet wire table, the "feet per ohm" (at 25° C) and the "ohms per 1,000 feet" (at 25° C) are given for all wire sizes.

The values given are for annealed copper wire. Magnet wire is annealed, but it may be necessary at times to know the resistance values for hard drawn wire. It has been found that hard drawing *increase* the resistance per given length by approximately 3 per cent.

Effect of Temperature upon the Resistance of Wire

The resistance of copper wire varies with the temperature. The relation is expressed by the following equation (see *Section 44* of this *Handbook*):

$$R_2 = R_1\left[1 + \alpha\,(t_2 - t_1)\right] \quad ohms$$

Where: R_2 = the resistance in ohms at Centigrade temp. t_2
t_1 = the initial temperature, or "temperature of reference", in degrees C
t_2 = the temperature attained in degrees C
R_1 = the resistance in ohms at temp. t_1
α = the temperature coefficient at the initial temperature. For ordinary annealed copper wire it is 0.00393 at t_1 = 20 degrees C.

It will be observed from the data chart in *Sect. 44* that the temperature coefficient varies with the conductivity; hence, extremely accurate calculations involving resistance and temperature cannot be made unless the actual temperature coefficient of the copper is known. For practical calculations involved in radio work, the temperature coefficient of 0.00393 at t_1 = 20° C is sufficiently accurate.

Effect of Winding Strains upon the Resistance of Magnet Wire in a Coil

The d-c resistance of a conductor varies inversely as the cross-sectional area. Therefore, if the wire in a coil is reduced in cross-sectional area by excessive tension in winding, the resistance naturally *increases*. However, the resistance of copper wire also is affected by the distortions in its structure that occur during winding, so even with the area unchanged, winding changes the resistance of the wire because it hardens slightly during bending around the coil form. There are other variables which affect the resistance of the wire, but in general, those described here are of such magnitude in comparison with the others that no attention need be given to the causes for other minor resistance changes.

The Current-Carrying Capacity of Wire Wound to Form a Coil

The current-carrying capacity of wire wound into the form of a coil depends upon how fast the heat developed within the wire (by the flow of the current against its resistance) can be dissipated. This depends upon several factors, the most important of which are:

1. The ratio of the length to the diameter of the coil (this affects the total surface area effective for ventilation).
2. The heat conductivity of the form material upon which the coil is wound, and also of the core (if one is used).
3. Whether the coil is impregnated or not.
4. The amount of ventilation the coil gets when it is mounted in its operating position and location.
5. The proximity of hot objects such as rectifier tubes, etc.

It is evident, therefore, that the safe current-carrying capacity of the wire of which a coil is constructed may vary over wide limits depending upon the physical make-up of the coil and its environment when in use. In general, when a coil used in radio equipment is made of cotton, silk, or enamel-covered wire and mounted so that it is well ventilated (as in the case of single-layer or "open" coils), 1,000 circular mils of wire cross-section per ampere of current should be provided. In coils that are not well-ventilated (such as closely wound multilayer coils, enclosed in housings, etc.), 1,500 circular mils per ampere should be provided.

The safe current-carrying capacities of the various sizes of wire (at 1,500 CM. per ampere) is tabulated in the second column from the extreme right of the accompanying *Wire Table*. The safe current-carrying capacity of any size wire at 1,000 CM. per ampere may be quickly calculated by dividing the circular mil area of the wire (listed in Column 3) by 1,000.

How to Determine Temperature Rise of a Current-Carrying Coil

One way of determining the temperature rise of a given quantity of wire or a coil, is by measuring its resistance when hot and when cold. Then the temperature rise is—

$$Temp.\ Rise = \frac{Rh - Rc}{Rc}\ (234.5 + Tc)$$

Where Rh = Resistance in ohms when hot
Rc = Resistance in ohms when cold
Tc = Temperature when cold

(Please see Wire Table on next page)

BARE & INSULATED COPPER WIRE DATA TABLE

Gauge No. B. & S.	Diam in Mils*	Area in Circular Mils	Feet per Ohm (25° C.)	Ohms per 1,000 feet (25° C.)	Feet Per Pound					Turns Per Linear Inch†						Turns per Square Inch†			Safe Current Carrying Cap. at 1,500 CM per Amp. ‡	Current Required to Fuse Wire
					Bare	S.S.C.	D.S.C.	S.C.C.	D.C.C.	Bare	S.S.C.	D.S.C.	S.C.C.	D.C.C.	Enam.	Enamel +S.C.C	D.C.C.	S.C.C.		
1	289.3	83,690	7,914	.1264	3.95	—	—	3.93	3.91	—	—	—	—	—	—	—	—	—	55.7	—
2	257.6	66,370	6,276	.1593	4.98	—	—	4.95	4.92	—	—	—	—	—	—	—	—	—	44.1	—
3	229.4	52,640	4,977	.2009	6.28	—	—	6.24	6.20	—	—	—	—	—	—	—	—	—	35.0	—
4	204.3	41,740	3,947	.2533	7.91	—	—	7.87	7.80	—	—	—	—	—	—	—	—	—	27.7	—
5	181.9	33,100	3,130	.3195	9.98	—	—	9.90	9.83	—	—	—	—	—	—	—	—	—	22.0	—
6	162.0	26,250	2,482	.4028	12.58	—	—	12.48	12.37	—	—	—	5.6	5.44	—	—	—	—	17.5	—
7	144.3	20,820	1,969	.5080	15.87	—	—	15.72	15.62	—	—	—	6.23	6.08	—	—	—	—	13.8	—
8	128.5	16,510	1,561	.6405	20.01	—	—	19.82	19.64	—	—	—	6.94	6.8	7.6	—	—	—	11.0	—
9	114.4	13,090	1,238	.8077	25.23	—	—	25.00	24.60	—	—	—	7.68	7.64	8.6	—	—	—	8.7	—
10	101.9	10,380	981.8	1.018	31.82	—	—	31.6	30.9	—	—	—	8.55	8.51	9.6	84.8	80.0	87.5	6.9	333.0
11	90.74	8,234	778.7	1.284	40.12	—	—	39.8	38.8	—	—	—	9.60	9.58	10.7	105.	97.5	110.	5.5	284.0
12	80.81	6,530	617.5	1.619	50.59	—	—	50.2	48.9	—	—	—	10.80	10.62	12.0	131.	121.	136.	4.4	235.0
13	71.96	5,178	489.7	2.042	63.80	—	—	63.2	61.5	—	—	—	12.06	11.88	13.5	162.	150.	170.	3.5	200.0
14	64.08	4,107	388.3	2.575	80.44	—	—	79.6	77.3	15.6	—	—	13.45	13.10	15.0	198.	183.	211.	2.7	166.0
15	57.07	3,257	308.0	3.247	101.4	100.5	100.	100.0	97.3	17.5	—	—	14.90	14.68	16.8	250.	223.	262.	2.2	139.0
16	50.82	2,583	244.2	4.094	127.9	126.6	125.	124.0	119.	19.6	—	—	17.20	16.40	18.9	306.	271.	321.	1.7	117.0
17	45.26	2,048	193.7	5.163	161.8	159.2	158.	155.	150.	22.0	—	—	18.80	18.10	21.2	372.	329.	397.	1.3	99.0
18	40.30	1,624	153.6	6.510	203.4	200.8	198.	196.	188.	25.0	—	—	21.00	20.00	23.6	454.	399.	493.	1.1	82.8
19	35.89	1,288	121.8	8.210	256.5	252.5	248.	247.	237.	27.8	—	—	23.60	21.83	26.4	553.	479.	592.	.86	66.7
20	31.96	1,022	96.6	10.35	323.4	319.	312.	311.	298.	31.0	27.	25.	26.40	23.91	29.4	725.	625.	775.	.68	58.3
21	28.46	810.1	76.61	13.05	407.8	398.	389.	389.	370.	35.0	30.	27.	29.70	26.20	33.1	895.	754.	940.	.54	49.3
22	25.35	642.4	60.75	16.46	514.2	504.	493.	491.	461.	39.0	34.	30.5	32.00	28.58	37.0	1,070.	910.	1,150.	.43	41.2
23	22.57	509.5	48.18	20.76	648.4	645.	631.	624.	584.	44.0	38.	34.	34.30	31.12	41.3	1,300.	1,080.	1,400.	.34	34.5
24	20.10	404.0	38.21	26.17	817.7	795.	779.	778.	745.	50.0	43.	38.	37.70	33.60	46.3	1,570.	1,260.	1,700.	.27	28.9
25	17.90	320.4	30.30	33.00	1.031.	1,004.	966.	958.	903.	56.0	47.	41.	41.50	36.20	51.7	1,910.	1,510.	2,060.	.21	24.6
26	15.94	254.1	24.03	41.62	1,300.	1,240.	1,202.	1,188.	1,188.	63.0	52.	45.	45.30	39.90	58.0	2,300.	1,750.	2,500.	.17	20.6
27	14.20	201.5	19.06	52.48	1,639.	1,615.	1,542.	1,533.	1,422.	70.0	58.	50.	49.40	42.60	64.9	2,780.	2,020.	3,030.	.13	17.7
28	12.64	159.8	15.11	66.17	2,067.	2,023.	1,917.	1,903.	1,759.	79.0	64.	53.	54.00	45.50	72.7	3,350.	2,310.	3,670.	.11	14.7
29	11.26	126.7	11.98	83.44	2,607.	2,625.	2,485.	2,461.	2,207.	88.0	71.	58.	58.80	48.00	81.6	3,900.	2,700	4,300.	.084	12.5
30	10.03	100.5	9.50	105.2	3,287.	3,325.	2,909.	2,893.	2,534.	100.	80.	66.	64.40	51.10	90.5	4,660.	3,020.	5,040.	.067	10.25
31	8.92	79.70	7.54	132.7	4,145.	3,820.	3,683.	3,483.	2,768.	112.	87.	71.	69.00	56.80	101.	5,280.	—	5,920.	.053	8.75
32	7.95	63.21	5.98	167.3	5,227.	4,876.	4,654.	4,414.	3,737.	125.	99.	76.	75.00	60.20	113.	6,250.	—	7,060.	.042	7.26
33	7.08	50.13	4.74	211.0	6,591.	6,243.	5,689.	5,688.	4,697.	141.	105.	83.	81.00	64.30	127.	7,360.	—	8,120.	.033	6.19
34	6.31	39.75	3.76	266.0	8,310.	7,757.	7,111.	6,400.	6,168.	159.	110.	88.	87.60	68.60	143.	8,310.	—	9,600.	.026	5.12
35	5.62	31.52	2.98	335.0	10,485.	9,660.	8,534.	8,393.	6,737.	179.	130.	104.	94.20	73.00	158.	8,700.	—	10,900.	.021	4.37
36	5.00	25.00	2.36	423.0	13,210.	11,907.	10,040.	9,846.	7,877.	200.	140.	110.	101.	78.50	175.	10,700.	—	12,200.	.017	3.62
37	4.45	19.83	1.87	533.4	16,660.	13,474.	10,670.	11,636.	9,309.	222.	150.	115.	108.	84.00	198.	—	—	—	.013	3.08
38	3.96	15.72	1.49	672.6	21,010.	16,516.	14,220	13,848.	10,660.	250.	160.	120	115.	89.10	224.	—	—	—	.010	2.55
39	3.53	12.47	1.18	848.1	26,500.	22,260.	16,520	18,286.	11,910.	285.	180.	130.	122.5	95.00	248.	—	—	—	.008	2.20
40	3.14	9.88	.94	1,069.0	33,410.	26,950.	21,330.	24,381.	14,222.	321.	200	140.	130.	102.50	282.	—	—	—	.006	1.86
41	2.80	7.84	.75	1,323.0	42,110.	—	—	30,610.	17,920.	—	—	—	153.	112.	—	—	—	—	.005	—
42	2.50	6.22	.60	1,667.0	53,110.	—	—	38,700.	22,600.	—	—	—	168.	124.	—	—	—	—	.004	—
43	2.22	4.93	.47	2,105.0	66,970.	—	—	48,600.	28,410.	—	—	—	192.	140.	—	—	—	—	.003	—
44	1.98	3.91	.39	2,655.0	84,440.	—	—	61,400.	35,950.	—	—	—	210.	153.	—	—	—	—	.0025	—

*A mil is 1/1000 (one thousandth) of an inch.

†These figures are only approximate, as they depend upon the thickness of the insulation. This, in turn, depends upon the manufacturer of the wire

‡The safe current-carrying capacity in *amperes* (at 1000 CM per ampere) is equal to the circular mil area (Column 3) divided by 1000.

Note: **For hard-drawn copper, increase resistance value approx. 3%.**

Copyright by
RADIO & TECHNICAL PUBLISHING CO.

SINGLE-LAYER AIR-CORE COIL DESIGN CHARTS

THE use of formulae for the design of single-layer air-core inductance coils is not very convenient or rapid because of the tedious, involved computations necessary. In order to simplify this work, and rapidly obtain coil data accurate enough for ordinary coil design work, the two alignment charts presented on the next page have been devised. They enable one to design a single-layer air-core inductance, coil, or solve resonant circuit problems, in a few minutes simply by the use of a straight-edge, pencil and paper.

Chart No. 1 at the left need be used only when the coil is to be tuned to resonance to some frequency by a condenser. In such cases, it may be employed to find any one of the three quantities *inductance* (*L*), *capacitance* (*C*), or *wavelength* λ (or *frequency f*), of the resonant circuit, if the other two are known.

Chart No. 2 is for finding the actual coil winding specications—inductance (*L*), length of coil (*l*), turns-per-inch (*n*) and diameter of coil (*d*)—with the aid of the tabulated data which will be found in the Copper Wire Data Table in *Section 52* of this Handbook.

The procedure for using each of these charts is explained graphically by the *"KEY"* illustration at its lower right-hand corner—and in greater detail by the following typical examples:

Example No. 1; What must be the inductance (*L*) of the secondary winding of an air-core r-f transformer if it is to tune to 500 meters (600 kc) with a 0.00035-mfd. condenser?

Solution: Referring to *Chart 1*, draw a line (A) connecting the 0.00035 point on the *C* scale and the 500 point on the λ (wavelength) scale (the two *known* values). This intersects the *L* scale at 201. The required inductance (*L*) of the coil is therefore 201 microhenries (the dotted line (A) on the chart has been drawn especially to show the solution for this problem).

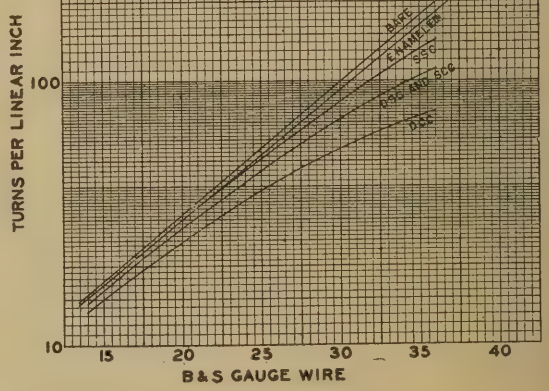
*For resonance formulae and single-layer air-core coil inductance formulae, see *Sections 60* and *67* of this *Handbook*.

Example No. 2: How many turns of wire will be required and how long will the winding of this 201-micro henry coil be if it is wound with No. 27 double sil covered (DSC) wire on a 2-inch diameter form?

Solution: Referring to the Copper Wire Data Table o *Page 673* in *Section 52* of this *Handbook*, we fin that No. 27 DSC wire winds to 50 turns-per-inch The three *known* values are therefore *L-201*, *d-* and *n-50*. The *unknown* value is *l*. Now, referrin to *Chart 2* here, draw a line (B) connecting the 20 point on the *L* scale and the *2* point on the *d* scal (see *KEY* diagram at lower right of chart). Thi intersects the *INDEX LINE* at point *"e"*. No draw a line (C) through *this* point *"e"* and the 5 point on the *n* scale. This line intersects the scale at 1.34". The length (*l*) of the coil whe wound will therefore be 1.34" (the dotted lines (B and (C) on the chart have been drawn especiall to show the solution for this problem).

Since this wire winds to 50 turns per inch, ther will be a $50 \times 1.34 = 67$ turns of wire on the coil. *An*

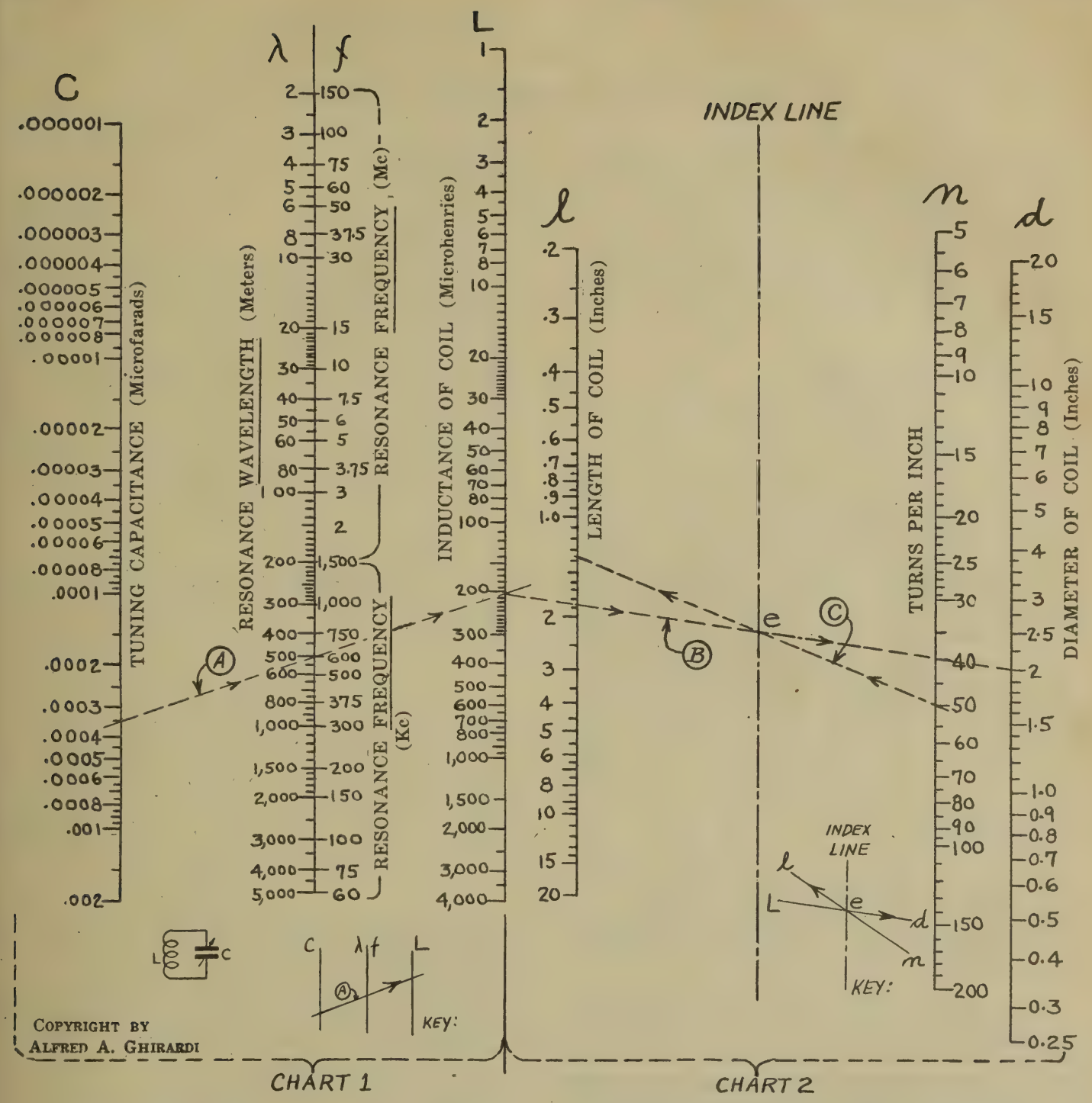
Instead of referring to the Copper Wire Data table fo the turns-per-inch information required when designin such coils the following graph may be consulted.



Courtesy General Radio Co.

Turns-per-linear inch of wires having various types of insulation (*Tight Wound*)

SEE CHARTS ON NEXT PAGE



How to use Chart 1:

Locate (on the proper scales) the two points corresponding to the two *known* values *C*, λ (or *f*), or *L*. Draw a line through these two points and intersecting the *third* scale (see *KEY* diagram at lower right of chart). This point of intersection determines the value of the *unknown* quantity.

How to use Chart 2:

Locate (on the proper scales) the two points corresponding to the *known* values *l*-and-*n*, or *L*-and-*d*. Draw a line through these two points, and intersecting the "*INDEX LINE*" (see *KEY* diagram at lower right of chart). Now draw a line through this point of intersection and the point corresponding to the third *known* value. The point of intersection of this line with the remaining, scale, gives the value of the *unknown* quantity.

This chart may also be operated in the *reverse* direction, always making sure that the correct *pairs* of scales are connected together, as shown by the "Key" at the lower right of the chart. Thus, for example, if it is known that a particular single-layer air-core coil contains a certain number of turns of wire of a certain kind and size wound on a form of certain diameter, its inductance (*L*) may be found quickly from this chart.

For Examples of the Use of these Charts See Accompanying Text on page 674.

POWER TRANSFORMER DESIGN CHART

RADIO service men are sometimes called upon to rewind a faulty power transformer for which no suitable replacement unit is readily available, or to design the windings needed for a particular transformer core which is already on hand and which is to be utilized to make a transformer that will deliver certain known required voltages. The chart presented here will assist in such work.

The Core of the Transformer

Perhaps the most important factors in designing the transformer windings are the amount and quality of core material available. The core size and material affect the performance of a transformer because the entire energy circulating in the transformer (except the small amount of energy dissipated as resistance loss in the primary winding) must be transformed from *electrical energy* in the primary winding to *magnetic energy* in the core, and then reconverted back into *electrical energy* in the secondary. Since the core is one of the main links in this energy chain, the quality and amount of core material affects quite definitely the power that any transformer will handle without serious energy losses, overheating, etc. Therefore, the electrical rating, as well as the physical size of the transformer is determined largely by the size and material of the core. The electrical efficiency of the transformer is also greatly affected by them.

Present practice is to use thin high grade silicon-steel sheet punchings (about No. 29 gauge) for power transformer cores, and it will be assumed that this type of material is to be used for the core of the transformer under consideration.

The inductance of a coil wound upon a transformer core depends not only upon the number of turns in the winding but also upon the magnetic *permeability* of the core material. For air-cored transformers, the permeability is 1; for iron and certain grades of steel the permeability may be as high as 1,000 or more. However, the permeability does not depend upon the core material alone—it also depends upon the flux density of the magnetism in the core. Consequently, in all transformer design calculations, even after the core material has been selected the magnetic flux density which is to exist in the core during normal operation must be decided upon, for this affects all the other design factors. For small transformers and cores of ordinary grades of silicon sheet steel, the cores are usually operated at a flux density of about 75,000 lines per square inch for 25-cycle line operation, and about 50,000 lines per square inch for 60-cycle line operation.

What the Transformer Turns-Per-Volt Chart Tells

When the flux density and the core area* of a given small power transformer core are known, the following alignment chart (*reproduced here through the courtesy of the General Electric Co.*) enables one to determine the number of primary-winding turns of wire to wind on that core per volt of applied voltage (for either 25-cycle or 60-cycle line operation). It also enables one to determine the number of turns of wire to wind for one or more secondary windings that are to develop certain desired voltages. The wires sizes may be determined separately as will be explained later.

Basis of the Chart

The fundamental principle that 10^8 magnetic lines of force cut per second will induce one volt of e.m.f. in a conductor, is the basis of the equation.

$$E = \frac{BANf}{10^8} \times 4.44$$

where E is the e.m.f. induced, A the area of the core, B the magnetic flux density in the same units as A, f the frequency in cycles per second, and N the number of turns. For small power transformers, a more useful equation may be obtained by solving for N/E (turns per volt). We get:

$$\frac{N}{E} = \frac{10^8}{4.44\ BAf}$$

The transformer design chart presented here is an alignment chart of this equation.

How to Use the Chart to Determine the Number of Turns for Each Winding

The following example will illustrate the use of the chart for transformer design.

Example: Suppose a simple power transformer is to b

—(Cont'd on next page)

*Note: There are two widely used forms of transformer cores—the shell type and the core type. The *shell* type has a center leg which accommodates the windings, and the cross-sectional area of this center leg is made equal to twice that of *each* side leg. (This is because the center leg carries the total magnetic flux, whereas each side leg carries only half of it.) Therefore, for the shell type core the core area is taken as the cross-section area of the *center-leg*—in square inches.

The *core* type is simply rectangular (without any center leg), and each leg carries the *total* magnetic flux. Therefore for the core type the core area is taken as the cross-section area of *one leg.*

wound on a core ½ square inch in cross-sectional area and the proper flux density for the grade and type of core steel to be used in 50,000 lines (50 kilolines) per square inch. (the proper flux density for different grades of steel may be obtained from standard electrical engineering texts or from core-steel manufacturers.) The primary of this transformer is to connect to the 110-volt 60-cycle lighting circuit. A secondary winding which is to deliver 5 volts, and one to deliver 1,000 volts, are to be provided. The primary and secondary windings are to be wound over the center leg of the core.

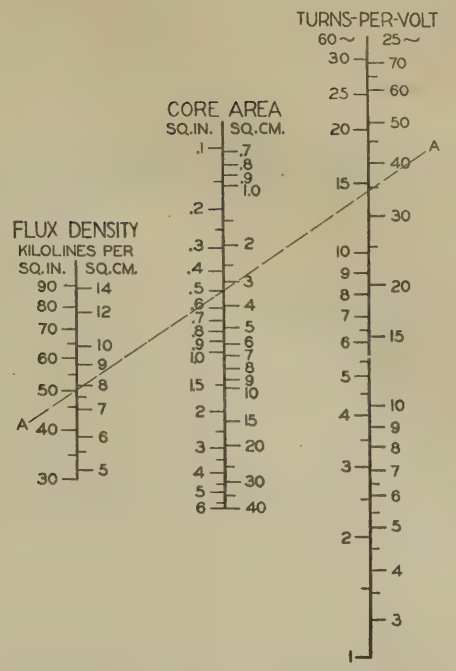
Solution: Referring to the chart, we lay a ruler between the 50 kiloline point on the *FLUX DENSITY scale* (*SQ. IN.* side) and the 0.5 sq. inch point on the CORE AREA scale. The line *A-A* is drawn through these two points. This line meets the 60-cycle *TURNS-PER-VOLT* scale at about 14 turns-per-volt. Therefore, for every volt the primary connects to, or for every volt desired from the secondary winding, 14 turns must be wound. The primary, then, requires 110 × 14 = 1540 turns, and the 5-volt secondary must have 5 × 14 = 70 turns.

The high-voltage secondary to deliver 1,000 volts must have 1,000 × 14 = 14,000 turns. For high-voltage secondary windings, a small percentage of turns should be added to allow for the voltage drop due to resistance of the small wire used, so that the available output voltage will be as high as anticipated.

(The flux density in the core of a transformer of this type is nearly the same from no-load to full-load.)

If the transformer were designed for operation from a 25-cycle line, then the turns-per volt would be about 34 (the point where the line *A-A* crosses the 25-cycle scale of the "TURNS-PER-VOLT" line).

The chart shown here also has a *SQ.CM.* scale for use when the flux density is specified in kilolines per sq. *cm.* and the core area is specified in sq. cm.



TRANSFORMER TURNS-PER-VOLT CHART: Knowing the flux density and the core area, the turns-per-volt for either a primary or a secondary winding may be determined by merely drawing the straight line (*A-A*) from the proper point on the *"FLUX DENSITY"* line through the proper point on the *"CORE AREA"* line—the extension of this line intersects the *"TURNS-PER-VOLT"* line at the point which represents the turns-per-volt of the transformer.

For convenience, the *"FLUX DENSITY"* line has "kilolines per square inch" and "kilolines per square centimeter" scales. The *"CORE AREA"* line has "square inch" and "square centimeter" scales. The "TURNS-PER-VOLT" line gives values for 60 cycles on the left, and for 25 cycles on the right.

To Determine the Size of Wire Necessary for Each Winding

The determination of the size of wire for each winding resolves itself into two steps.

First, if the current each secondary winding is to deliver is already known from the requirements of the transformer, the wire size for each secondary winding may be determined directly by referring to the *"Safe Current Carrying Cap. at 1500 CM. per Amp."* in the Copper Wire Table in *Section 52* of this *Handbook*. A safe rule to allow 1,500 circular mils per ampere for transformers over 50 watts, and 1,000 circular mils per ampere for transformers under 50 watts. (many commercial designs use around 800 cir. mils per ampere.)

If the current each secondary winding is to deliver is not known, but the watts output of each is known, the current may be determined by dividing the *watts* by the *voltage*.

To find the size wire for the primary winding:

(1) find the *total maximum secondary watts* (W_s)

$$W_s = E_1 \times I_1 + E_2 \times I_2 + E_3 \times I_3 + \text{etc.}$$

where $E_1 \times I_1$, etc., refers to the current and voltage (or wattage) in each of the secondary windings.

(2) Now, assuing a 90 per cent overall transformer efficiency (which is a fairly reasonable value for small transformers), the *total* watts (W_p) needed for the primary winding is

$$W_p = \frac{W_s}{0.9}$$

(3) Now assuming a power factor of 90 per cent and a primary voltage E_p, the primary current in amperes is:

$$I_p = \frac{W_p}{0.9 \times E_p} = \frac{W_s}{0.9 \times 0.9\, E_p} = \frac{W_s}{0.81\, E_p}$$

(4) Knowing the amount of current the primary winding must carry, the size wire for the primary is determined from the Copper Wire Table in ***Section 52* of this *Handbook*.**

Space Required for the Windings

When a transformer for a certain purpose is to be wound on a given core, it is wise at this point to calculate the actual space the windings will take up (see Turns Per Square Inch" columns in the Copper Wire Table in *Section 52*) in order to determine whether there is enough winding space available on the core.

If this precaution is not observed, it may be found later (after part of the windings have been wound on the core) that there is insufficient room for them. If the windings will not fit into the available space, the winding may be redesigned, or a larger core used. Use wire having thinner insulation covering, or the next smaller size wire may sometimes be used (although this will result in higher operating temperature for the windings). Then, too, a thicker stack of the same sized core stampings will increase the core area and thus make necessary a smaller number of turns per volt, thus decreasing the total number of turns and the space required for each winding.

POWER TRANSFORMER HIGH-VOLTAGE WINDING REQUIREMENTS FOR OPERATING VARIOUS RECTIFIER TUBES

(also, rectifier tube characteristics)

IT is often necessary for radio service men to determine the value of the voltage which the high-voltage secondary winding of the power transformer* in a receiver must deliver to the rectifier tube in order that a certain d-c voltage (as specified by the manufacturer of the receiver) shall be available at the output terminals of the *B*-filter. This information is necessary when a new receiver is designed, and it is often necessary when the power transformer is to be replaced in an inoperative or otherwise faulty "orphan" set for which no voltage specifications are readily available. The proper transformer voltage required can be determined easily by the method which will be described here, if the total plate and bleeder currents, resistance of the filter choke coils, and the load characteristics of the type of rectifier tube used in the receiver are known. The "load characteristics" of the types of rectifier tubes commonly used in receivers are shown in the eight sets of graphs which follow. (These are reproduced here through the courtesy of the engineering department of the *Raytheon Production Corp.*) Each is labeled for identification.

Calculations for Typical Problem

In order to show exactly how a calculation of this kind is carried out, let us consider a typical example:

We will assume that the sum of all the plate and screen currents in the entire receiver is 50 ma. and that the bleeder current (the current flowing through the "bleeder" resistance) is 10 ma. The value for the plate and screen currents could be obtained from the set manufacturer's data or from the Tube Characteristic Chart presented in *Section 54* of this book. The value of the "bleeder" current could be calculated by dividing the voltage across the bleeder resistor (which is usually the highest d-c voltage) by the resistance of the bleeder. We will assume further that a single filter choke having a resistance of 500 ohms is used, that a voltage of 250 volts d-c is required across the bleeder resistor (this is the voltage output of the *B*-filter system), and that the input tank condenser has a value of 4 mfd. (the size of the tank condenser may be determined from the schematic circuit diagram of the receiver, or by checking with a capacity meter). The problem is to find the r-m-s ("root-mean-square" or "effective" value) voltage which each half of the high-voltage winding of the power transformer must deliver to the rectifier tube when the receiver is operating.

If a type '80 rectifier tube is used, then the set of load characteristic curves (which is shown on the page immediately following) for this tube, must be examined. It will be seen that there are three curves (one drawn *solid*, one drawn *dotted* and one drawn in *dot-dash* form) for each value of rectifier plate (anode) voltage specified. One curve is for each value of the filter tank (input) condenser C_1. Thus, if a 2-mfd. tank condenser and a rectifier plate voltage of 350 volts were employed, the *dotted* curve marked *2* would represent the load current—output voltage characteristic of the rectifier tube for that condition of operation, etc.

Now the horizontal scale on the rectifier characteristic curves shown here represents the d-c output current of the rectifier in milliamperes, and the vertical scale represents the d-c *input* voltage to the filter—not the d-c *output* voltage of the filter. Therefore, it is necessary to obtain the former value indirecly from the known constants of the problem. It is known that the desired d-c *output* voltage of the filter is 250 volts, and it is known that the current through the 500-ohm filter choke is 50 + 10 = 60 ma.; therefore, the d-c voltage drop across the choke is 0.06 × 500 = 30 volts. This means that the d-c *input* voltage to the filter must be equal to 250 plus 30, or 280 volts in order to obtain an *output* of 250 volts.†

Now we are prepared to refer to the load characteristic chart for the '80 type rectifier tube. Locate the 280-volt point on the vertical "output volts" scale, and locate the 60-ma. point on the horizontal "output-milliamperes" scale. Follow across horizontally from the 280-volt point and vertically from the 60-ma point into the curve sheet until the point of intersection is reached; this point will be found to occur nearly midway between the two solid-line curves labeled *3* and *4*. These curves represent operation with a 4-mfd. tank condenser and 300 and 250 volts per anode (plate voltage) respectively. Therefore, in our case since the point of intersection lies about midway between these curves, the voltage is about 275 volts.

Since the voltage output of the rectifier tube (plus the small internal voltage drop in the tube itself) is practically equal to the a-c voltage across each half of the high-voltage secondary winding of the power transformer, each half of this winding in our power transformer must deliver 275 volts. Therefore it must have a *total* high-voltage secondary voltage output (under load) of 275 × 2 = 550 volts. It must also have the necessary proper filament windings which will deliver the required low voltages to the filaments or heaters of all the tubes in the receiver.

If the filter were of the "choke-input" type, ($C_1 = 0$), then each half of the high-voltage winding would have to deliver a voltage represented by a point slightly above the No. 2 dot-dash characteristic curve which represents 350 volts per anode operation. By taking the proportional distances between the two adjacent dot-dashed curves and the intersection of the operating lines, the required voltage is found to be about 360 volts across each half of the winding; the *total* secondary voltage is then twice this value, or 720 volts. Notice that more input voltage (for a given output) is required when a choke-input type filter is used than when a condenser-input type filter is employed.

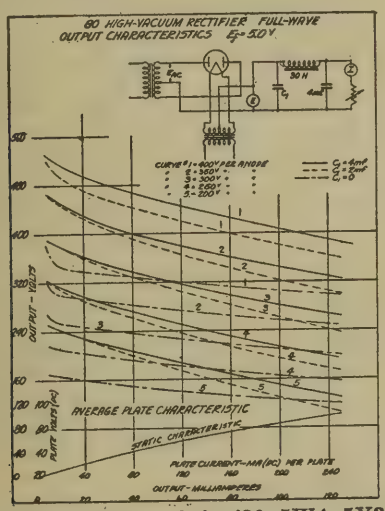
It is always well to allow an extra voltage margin to take care of conditions when the line voltage is below normal, etc. If this is done in our case, a 750-volt center-tapped secondary winding on the power transformer will be about right for the particular receiver and filter system originally specified in our problem. This same procedure may be followed for solving problems involving any of the other types of rectifier tubes whose load-voltage characteristics are shown here. *(Cont'd)*

*For actual design of the core and windings of the power transformer, see the *Transformer Design Chart* in *Section 54* of this *Handbook*.

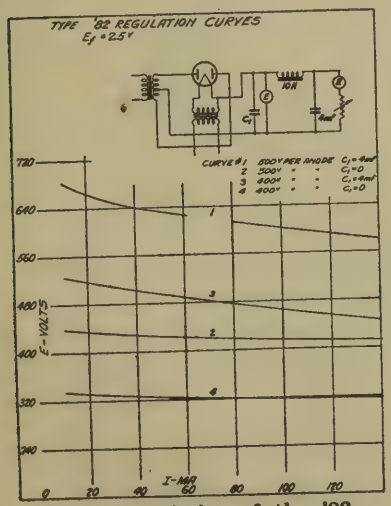
†For actual design of filter components, see the *Filter Design Chart* in *Section 56* of this *Handbook*.

Precautions to Observe in Rectifier Tube Applications

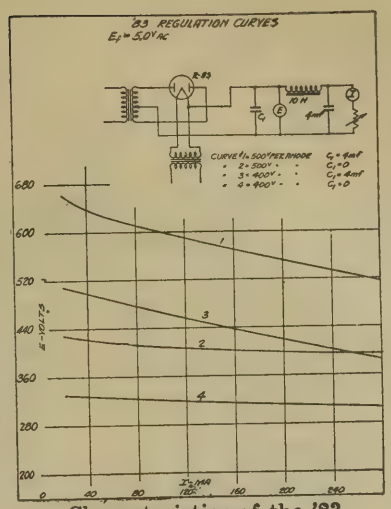
In the application of rectifier tubes care should be taken that the published maximum ratings are not exceeded. Rectifier tubes are rated for *Maximum A-C Plate Voltage* (the maximum *RMS* value of a-c voltage that should be applied to the plate of the tube), and for *Maximum D-C Output Current* (the highest value of d-c plate current, average over one a-c cycle, at which the tube should be operated). They are also rated for *Maximum Peak Plate Current* (the maximum instantaneous peak value of plate current that should be permitted to flow through the tube), and for *Maximum Inverse Peak Voltage* (which is the maximum instantaneous peak value of plate voltage that should be applied to the tube during the half-cycle when the plate is negative and no current is flowing to the plate). The *Voltage Drop* is the d-c plate voltage corresponding to some specified value of d-c plate current, usually equal to the maximum d-c output current per plate.


80 HIGH-VACUUM RECTIFIER FULL-WAVE
OUTPUT CHARACTERISTICS Ef = 5.0 V.
AVERAGE PLATE CHARACTERISTIC
STATIC CHARACTERISTIC
OUTPUT - VOLTS
OUTPUT - MILLIAMPERES
PLATE CURRENT - MA (DC) PER PLATE

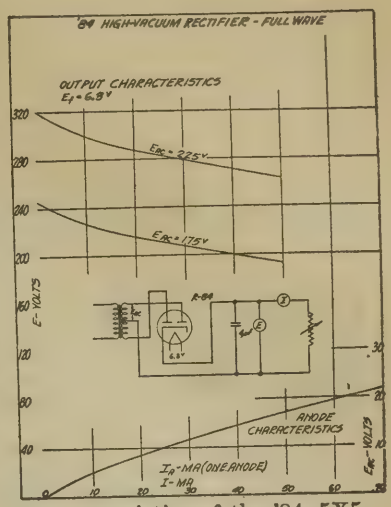
Characteristics of the '80, 5W4, 5Y3G, 5Y4G, and 5Z4 rectifier tubes.



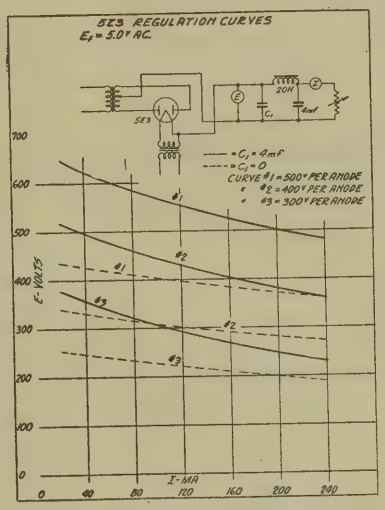
Characteristics of the '82 rectifier.



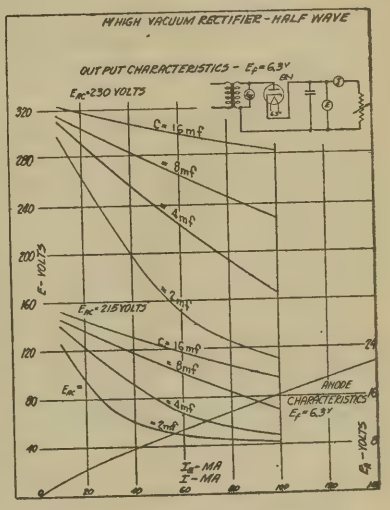
Characteristics of the '83 rectifier.



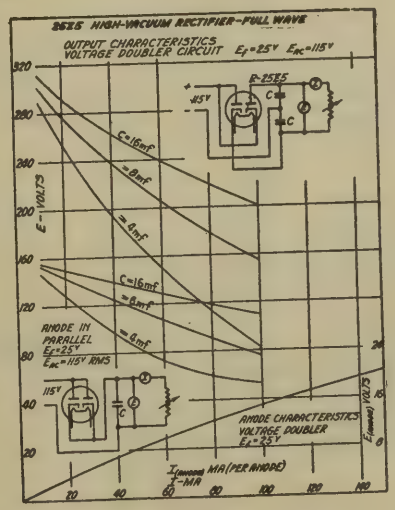
Characteristics of the '84, 5X5, and 5X5G, rectifier tubes



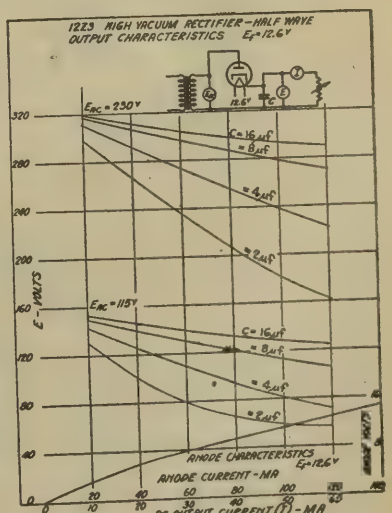
Characteristics of the 5T4, 5U4, 5U4G, 5X4G, 5Z3, and 6ZY5 rectifier tubes



Characteristics of the 1-V rectifier.


25Z5 HIGH-VACUUM RECTIFIER - FULL WAVE
OUTPUT CHARACTERISTICS
VOLTAGE DOUBLER CIRCUIT Ef = 25 V EAC = 115 V
ANODE IN PARALLEL
Ef = 25 V
EAC = 115 V RMS
ANODE CHARACTERISTICS
VOLTAGE DOUBLER
Ef = 25 V
E - VOLTS
I - MA

Characteristics of the 25Z5, 25Z6, and 25Z6G rectifier tubes


12Z3 HIGH VACUUM RECTIFIER - HALF WAVE
OUTPUT CHARACTERISTICS Ef = 12.6 V
ANODE CHARACTERISTICS
Ef = 12.6 V
ANODE CURRENT - MA
DC OUTPUT CURRENT (I) - MA
E - VOLTS

Characteristics of the 12Z3 rectifier.

Courtesy Raytheon Production Corp.

FILTER DESIGN CHART

For Low-Pass Pi Type Filters

AN electric filter consists of a combination of condensers and inductances in a suitable circuit designed either to *pass* or to *by-pass* a specified band of frequencies in the current supply to a given load.

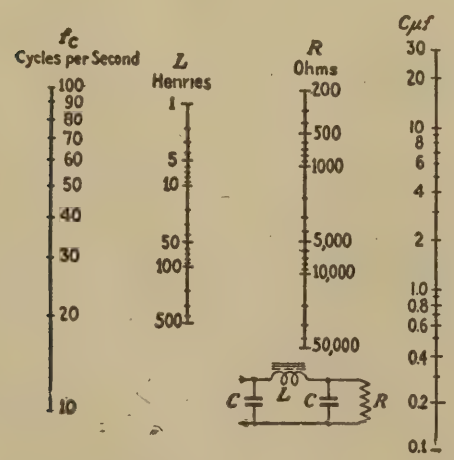
When it passes a band of frequencies between zero and f_c, (the "cut-off" frequency) and by-passes frequencies higher than f_c, it is called *low-pass* filter.

When it passes all frequencies higher than f_c, and by-passes all frequencies lower than f_c, it is called a *high-pass* filter.

The cut-off frequency region (f_c) is not absolute, or sharply defined, in a single-section filter, but it can be made more sharp by employing several suitably designed sections.

Low-Pass Pi Type Filters

The alignment chart presented here is for the rapid design of simple low-pass filter sections of the "pi" or "brute-force" type composed of an inductance L and a



capacitance C. connected as shown in the basic schematic diagram below the chart. Notice that such low-pass filters have an inductance in series with the current supply to the load, R, (thus *passing* the low-frequency currents to it easily), and condensers in parallel with it (thus *by-passing* the high frequencies). Such filters employ an iron-cored inductance ("choke"), which in many cases is the field coil of the electro-dynamic loud speaker in the radio receiver, and either foil-paper or electrolytic type filter condensers. These filters are used for "smoothing out" the pulsating current delivered by the rectifier tube in a receiver. (This is fed into the filter at the *left* in the diagram.) Their output is the "smoothed" direct current which is used for "B" supply (this is fed into the *load* which is represented by resistance R in the diagram).

Most Desirable Cut-off Frequency for B-filter Use

For B-filter use, the "cut-off" frequency f_c (i.e., the frequency below which the filter is ineffective) should be below the frequency of the ripple or hum voltage which exists in the output of the rectifier tube. If the rectifier is of the *half-wave* type and operates from a 60-cycle line, this is *60* cycles. It is *120* cycles for a *full-wave* rectifier. In general, the lower the frequency of cut-off the better the filtering of the ripple frequency will be. Preferably the cut-off frequency should be *below* the lowest frequency which the audip circuits of the receiver (including the loudspeaker) are capable of handling.

Basis of the Design Chart

The alignment chart presented here is based on the basic low-pass filter design formulas:

$$C = \frac{318{,}300}{f_c\, R} \qquad (1)$$

$$\text{or } L = \frac{0.3183R}{f_c} \qquad (2)$$

$$\text{or } f_c = \frac{0.3183R}{L} \qquad (3)$$

where C is the capacitance in *microfarads*
L is the inductance in *henries*
f_c is the cut-off frequency in *cycles per second*
R is the load resistance in *ohms*

OPERATING DATA AND CIRCUIT DESIGN CHART FOR RESISTANCE-COUPLED A-F AMPLIFIERS AND PHASE INVERTERS

THE chart presented here through the courtesy of the Radio Corp. of America,—RCA Victor Division, summarizes in quick-reference form all the pertinent data service men require on the circuit constants, circuit arrangements, and tube operating conditions employed in resistance-coupled a-f amplifiers and phase inverters. Complete data is presented for all the types of tubes employed in such amplifiers in present-day radio equipment. Furthermore for each tube type, the data is given for three different values of plate-supply voltage E_{bb}, namely, 90, 180, and 300 volts. For each of these values of plate-supply voltage, the circuit constants are given for three different plate resistor (R_L) values.

Single-Stage Resistance-Coupled Triode Amplifier

Fig. 57-1 shows the typical circuit arrangement to be employed when a single triode (or one unit of a twin-triode tube with separate cathode terminals) is used in a resistance-coupled amplifier. The letters C_c, R_c, R_L, etc. correspond to those in the *Operating Data Chart* which follows later.

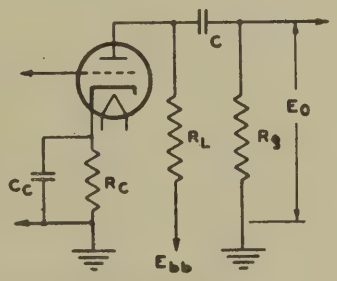


FIG. 57-1. — Circuit arrangement of resistance-coupled triode a-f amplifier using single *triode*, or one unit of a twin-triode type tube with separate cathode terminals.

The frequency characteristics of such a single-stage resistance-coupled triode amplifier (when the particular circuit constants specified in the chart are employed) is illustrated in Fig. 57-2. When designing such a triode resistance-coupled amplifier from the data supplied by the chart, the following precautions should be observed:

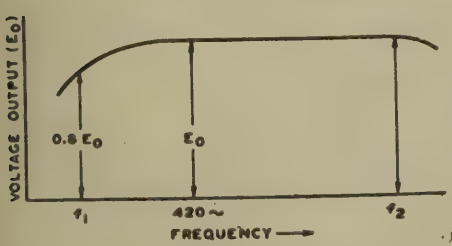


FIG. 57-2.—Frequency characteristic of a single-stage resistance-coupled *triode* a-f amplifier.

(A) Condensers C and C_c have been chosen to give output voltages equal to 0.8 Eo for f_1 of 100 cycles. For any other value of f_1, multiply values of C and C_c by $100/f_1$. In the case of condenser C_c, the values shown are for an amplifier with d-c heater excitation. When a.c. is used, depending on the character of the asscoiated circuits, the gain, and the value of f_1, it may be necessary to increase the value of C_c to minimize hum disturbances. It may also be desirable to have a d-c potential difference of approximately 10 volts between heater and cathode.

(B) f_2 = frequency at which high-frequency response begins to fall off.

(C) The voltage output of f_1 for n like stages equals $(0.8\ Eo)^n$.

(D) Decoupling filters are not necessary for two stages or less.

(E) For an amplifier of typical construction, the value of f_2 is well above the audio-frequency range for any value of R_L.

(F) Always use highest permissible value of R_g.

(G) A variation of $\pm$ 10% in values of resistors and condensers has only a slight effect on performance.

Single-Stage Resistanc-Coupled Pentode Amplifier

Fig. 57-3 shows the typical circuit arrangement to be employed when a pentode is used in a resistance-coupled amplifier. Here again, the various reference letters on the diagram correspond to those in the *Operating Data Chart* which follows later.

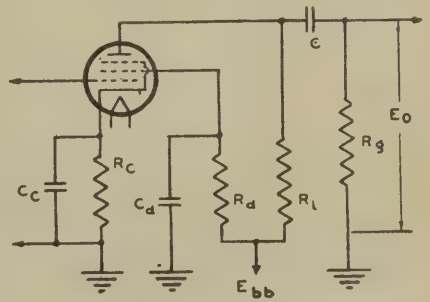


FIG. 57-3. — Circuit arrangement of a single-stage resistance-coupled *pentode* a-f amplifier.

The frequency characteristic of such a single-stage re-

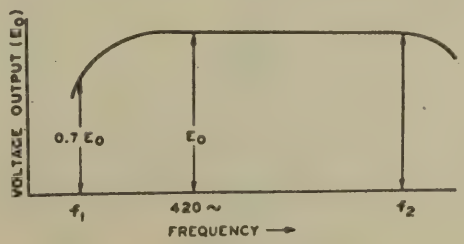


FIG. 57-4 — Frequency characteristic of a single-stage resistance-coupled *pentode* a-f amplifier.

sistance coupled pentode amplifier (when the particular circuit constants specified in the chart are employed) is illustrated in Fig. 57-4. When designing such a pentode resistance-coupled amplifier from the data supplied by the chart, the following precautions should be observed.

(A) Condensers C, C_c, and C_d have been chosen to give output voltages equal to 0.7 Eo for f_1 of 100 cycles. For any other value of f_1, multiply values of C, C_c, and C_d by $100/f_1$. In the case of condenser C_c, the values shown are for an amplifier with d-c heater excitation. When a.c. is used, depending on the character of the associated circuits, the gain, and the value of f_1, it may be necessary to increase the value of C_c to minimize hum disturbances. It may also be desirable to have a d-c potential difference of approximately 10 volts between heater and cathode.

(B) f_2 = frequency at which high-frequency response begins to fall off.

(C) The voltage output of f_1 for n like stages equals $(0.7\ Eo)^n$.

(D) Decoupling filters are not necessary for two stages or less.

(E) For an amplifier of typical construction, approximate values of f_2 for different values of R_L are: 0.1 meg., 2000 cps.; 0.25 meg., 10000 cps; 0.5 meg., 5000 cps.

(F) Always use highest permissible values of R_g.

(G) A variation of ± 10% in values of resistors and condensers has only a slight effect on performance.

Resistance-Coupled Phase Inverter Using Twin-Triode

Fig. 57-5 shows the typical circuit arrangement to be employed when a twin-triode type tube having a "common" cathode is used in a resistance-coupled phase inverter. Here again, the various reference letters on the diagram correspond to those in the *Operating Data Chart* on the pages which follow.

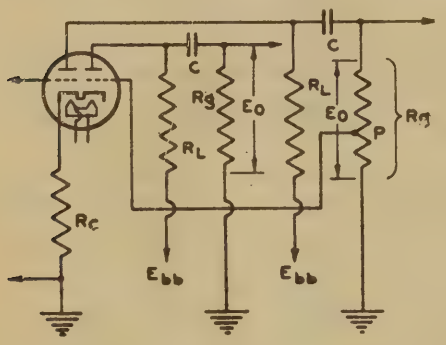


FIG. 57-5. — Circuit arrangement of a resistance coupled *phase inverter* using a twin-triode type tube having one cathode terminal.

The frequency characteristic of such a phase inverter (when the particular circuit constants specified in the chart are employed) is illustrated in Fig. 57-6. When designing such a phase inverter circuit from the data supplied by the chart, the following points should be observed.

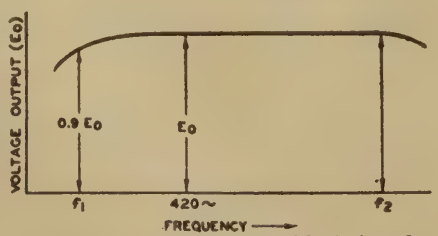


FIG. 57-6.—Frequency characteristic of resistance - coupled *phase inverter* using twin-triode type tube having one cathode terminal.

(A)
The signal input is supplied to the grid of the left-hand triode unit. The grid of the right-hand unit obtains its signal from a tap (P) on the grid resistor (R_g) in the output circuit of the left-hand triode unit. The tap (P) is chosen so as to make the voltage output of the right-hand unit equal to that of the left-hand unit. Its location is determined from the voltage gain values given in the Chart. For example, if the value of voltage gain is 20 (from the Chart). (P) is chosen so as to supply 1/20 of the voltage across (R_g) to the grid of the right-hand triode.

(B)
For phase-inverter service, the cathode resistor (R_L) should not be by-passed by a condenser. Omission of the condenser in this service assists in balancing the output voltages. The value of (R_L) is specified on the basis that both units are operating simultaneously at the same values of plate load and plate voltage.

Value of Blocking or Coupling Condenser in a Resistance-Coupled Amplifier Important

A mistake commonly made in resistance-coupled audio amplifiers is the use of an unnecessarily large blocking or coupling condenser (*C*). If the possibility of motorboating is to be minimized, the blocking condenser should be no larger than is absolutely necessary to obtain satisfactory transmission at the lowest useful frequency. An example is presented in certain receivers where, due to limitations imposed by the speaker and the effective baffle size, the lowest useful frequency for the amplifier to transmit might well be as high as 100 or 150 cycles. In such instances, assuming a grid leak of 0.5 megohms, the blocking condenser should not be more than 0.003 mfd.

Incidentally, another benefit accruing from the use of a blocking condenser no larger than is absolutely necessary is that the effective power output is increased. This is true because transmission of frequencies to the grid of the power output tube, lower than that which may be acoustically reproduced, simply uses up an appreciable part of the tube's power capability. Using a blocking condenser as large as 0.1 microfarad invites trouble.

Key to Chart on Following Pages

To quickly find the correct chart in which the data for any tube type is tabulated, look up the tube type-number here and refer to chart specified.

Tube Type	Chart No.	Tube Type	Chart No.	Tube Type	Chart No.
2A6	(14)	6F8-G (One Triode)	(5)	6R7	(10)
2B7	(1)	6J5	(5)	6R7-G	(10)
6A6	(8)	6J5-G	(5)	6S7	(11)
6B7	(1)	6J7 (Pentode)	(6)	6S7-G	(11)
6B8	(1)	6J7 (as a Triode)	(2)	6T7-G	(12)
6B8-G	(1)	6J7-G (Pentode)	(6)	6Z7-G	(13)
6C5	(2)	6J7-G (as a Triode)	(2)	53	(8)
6C5-G	(2)	6L5-G	(7)	55	(17)
6C6 (Pentode)	(6)	6N7	(8)	56	(15)
6C6 (as a Triode)	(2)	6N7-G	(8)	57 (Pentode)	(6)
6C8-G (One Triode)	(3)	6Q7	(9)	57 (as a Triode)	(2)
6F5	(4)	6Q7-G	(9)	75	(14)
6F5-G	(4)			76	(15)
				79	(16)
				85	(17)

(See Chart on following pages)

OPERATING DATA AND CIRCUIT DESIGN CHART FOR RESISTANCE-COUPLED A-F AMPLIFIERS & PHASE INVERTERS

KEY TO SYMBOLS USED IN CHART:

C = Blocking Condenser (μf) — Ebb = Plate-Supply Voltage (Volts) — Rc = Cathode Resistor (Ohms) — RL = Plate Resistor (Megohms)

Cc = Cathode By-Pass Condenser (μf) — Eo = Voltage Output (Peak Volts) — Rg = Grid Resistor (Megohms) — V.G. = Voltage Gain

Data for **2A6** tube will be found in chart No. **(14)**
Data for **6A6†** tube will be found in chart No. **(8)**

(1) 2B7, 6B7, 6B8, 6B8-G

Ebb [1]	90									180									300								
RL	0.1			0.25			0.5			0.1			0.25			0.5			0.1			0.25			0.5		
Rg [2]	0.1	0.25	0.5	0.25	0.5	1	0.5	1	2	0.1	0.25	0.5	0.25	0.5	1	0.5	1	2	0.1	0.25	0.5	0.25	0.5	1	0.5	1	2
Rc [3]	0.37	0.5	0.6	1.18	1.1	1.35	2.6	2.8	2.9	0.44	0.5	0.6	1.18	1.2	1.5	2.6	2.8	3	0.5	0.55	0.6	1.2	1.2	1.5	2.7	2.9	3.4
Re	2000	2200	2000	3500	3500	3500	5000	6000	6200	1000	1200	1200	1900	2100	2200	3300	3500	3500	950	1100	900	1500	1600	1800	2400	2500	2800
Cd	0.07	0.07	0.06	0.04	0.04	0.04	0.04	0.04	0.04	0.08	0.08	0.07	0.05	0.06	0.05	0.04	0.04	0.04	0.09	0.09	0.08	0.06	0.06	0.08	0.05	0.05	0.05
Cc	3	3	2.8	1.9	2.1	1.9	1.5	1.55	1.5	4.4	4.4	4	2.7	3.2	3	2.1	2	2.2	4.6	5	4.8	3.2	3.5	4	2.5	2.3	2.8
C	0.02	0.01	0.006	0.008	0.007	0.003	0.004	0.003	0.003	0.02	0.015	0.008	0.01	0.007	0.003	0.005	0.003	0.002	0.025	0.015	0.009	0.015	0.008	0.004	0.006	0.003	0.0025
Eo [3]	19	28	29	26	33	32	22	29	27	30	52	53	39	55	53	47	55	53	60	89	86	70	100	95	80	120	90
V.G. [4]	24	33	37	43	55	65	63	85	100	30	41	46	55	69	83	81	115	116	36	47	54	64	79	100	96	150	145

(2) 6C5, 6C5-G, (6C6, 6J7, 6J7-G, 57 as triodes):

Ebb [1]	90									180									300								
RL	0.05			0.1			0.25			0.05			0.1			0.25			0.05			0.1			0.25		
Rg [2]	0.05	0.1	0.25	0.1	0.25	0.5	0.25	0.5	1	0.05	0.1	0.25	0.1	0.25	0.5	0.25	0.5	1	0.05	0.1	0.25	0.1	0.25	0.5	0.25	0.5	1
Rc	2800	3400	3800	4800	6400	7500	11400	14500	17300	2200	2700	3100	3900	5300	6200	9500	12300	14700	2100	2600	3100	3800	5300	6000	9600	12300	14000
Cc	2	1.62	1.3	1.12	0.84	0.66	0.52	0.4	0.33	2.2	2.1	1.85	1.7	1.25	1.2	0.74	0.55	0.47	3.16	2.3	2.2	1.7	1.3	1.17	0.9	0.59	0.37
C	0.05	0.025	0.01	0.025	0.01	0.005	0.01	0.006	0.004	0.055	0.03	0.015	0.035	0.015	0.008	0.015	0.008	0.004	0.075	0.04	0.015	0.035	0.015	0.008	0.015	0.008	0.003
Eo [3]	14	17	20	16	22	23	18	23	26	34	45	54	41	54	55	44	52	59	57	70	83	65	84	88	73	85	97
V.G. [4]	9	9	10	10	11	12	12	12	13	10	11	11	12	12	13	13	13	13	11	11	12	12	13	13	13	14	14

Data for **6C6** tube will be found in charts No. **(2 and 6)**

(3) 6C8-G (one triode unit)‡:

Ebb [1]	90									180									300								
RL	0.1			0.25			0.5			0.1			0.25			0.5			0.1			0.25			0.5		
Rg [2]	0.1	0.25	0.5	0.25	0.5	1	0.5	1	2	0.1	0.25	0.5	0.25	0.5	1	0.5	1	2	0.1	0.25	0.5	0.25	0.5	1	0.5	1	2
Rc	3040	3700	4520	6770	7870	8830	12400	15000	16500	2420	3080	3560	5170	6560	7550	9840	12500	15600	2120	2840	3250	4750	6100	7100	9000	11500	14500
Cc	2.34	1.48	1.29	0.95	0.81	0.69	0.51	0.43	0.38	2.34	1.84	1.6	1.25	0.95	0.85	0.66	0.5	0.44	3.93	2.01	1.79	1.29	0.96	0.77	0.67	0.48	0.37
C	0.028	0.0115	0.006	0.011	0.0065	0.0035	0.006	0.0035	0.0015	0.028	0.012	0.0065	0.012	0.007	0.0035	0.007	0.004	0.0015	0.037	0.013	0.007	0.013	0.0065	0.004	0.007	0.004	0.002
Eo [3]	13	17	19	15	19	21	16	20	25	30	40	45	35	45	50	38	44	51	55	73	80	64	80	90	67	83	96
V.G. [4]	18	20	21	21	23	23	22	24	24	20	22	23	24	25	26	25	26	26	22	23	25	25	26	27	27	27	28

(4) 6F5, 6F5-G:

Ebb [1]	90									180									300								
RL	0.1			0.25			0.5			0.1			0.25			0.5			0.1			0.25			0.5		
Rg [2]	0.1	0.25	0.5	0.25	0.5	1	0.5	1	2	0.1	0.25	0.5	0.25	0.5	1	0.5	1	2	0.1	0.25	0.5	0.25	0.5	1	0.5	1	2
Rc	4400	4800	5000	8000	8800	9000	12200	13500	14700	1800	2000	2200	3500	4100	4500	6100	6900	7700	1300	1600	1700	2600	3200	3500	4500	5400	6100
Cc	2.5	2.1	1.8	1.33	1.18	0.9	0.76	0.67	0.58	4.4	3.3	2.9	2.3	1.8	1.7	1.3	0.9	0.83	5	3.7	3.2	2.5	2.1	2	1.5	1.2	0.93
C	0.02	0.01	0.005	0.01	0.005	0.003	0.005	0.003	0.0015	0.025	0.015	0.006	0.01	0.006	0.004	0.006	0.003	0.0015	0.025	0.01	0.006	0.01	0.007	0.004	0.006	0.004	0.002
Eo [3]	4	5	6	6	7	10	8	10	12	16	23	28	21	26	32	24	33	37	33	43	48	41	54	63	50	62	70
V.G. [4]	28 [d]	34 [b]	35 [c]	39 [b]	43 [c]	44	43	46	48	37	44	46	48	53	57	53	63	66	42	49	52	56	63	67	65	70	70

(5) 6F8-G (one triode unit)‡, 6J5, 6J5-G:

Ebb [1]	90									180									300								
RL	0.05			0.1			0.25			0.05			0.1			0.25			0.05			0.1			0.25		
Rg [2]	0.05	0.1	0.25	0.1	0.25	0.5	0.25	0.5	1	0.05	0.1	0.25	0.1	0.25	0.5	0.25	0.5	1	0.05	0.1	0.25	0.1	0.25	0.5	0.25	0.5	1
Rc	1650	2070	2380	3470	3940	4420	7860	9760	10690	1190	1490	1740	2330	2830	3230	5560	7000	8110	1020	1270	1500	1900	2440	2700	4590	5770	6950
Cc	2.80	2.66	1.95	1.85	1.29	1.0	0.73	0.55	0.47	3.27	2.86	2.06	2.19	1.35	1.15	0.81	0.62	0.5	3.56	2.96	2.15	2.31	1.42	1.2	0.87	0.64	0.54
C	0.06	0.029	0.012	0.035	0.012	0.007	0.0135	0.007	0.004	0.06	0.032	0.0115	0.038	0.012	0.006	0.013	0.007	0.004	0.06	0.034	0.012	0.035	0.0125	0.0065	0.013	0.0075	0.004
Eo [3]	11	14	17	12	17	19	14	18	20	24	30	36	26	34	38	28	36	40	41	51	60	43	56	64	46	57	64
V.G. [4]	11	12	13	13	13	13	13	13	13	13	13	13	14	14	14	14	14	14	13	14	14	14	14	14	14	14	14

—(Cont'd)

6J7, 6J7-G, 6C6, S7 (as pentodes). See also data in chart No. (2) for these tubes as triodes —(Cont'd)

(6)

Ebb [1]	90									180									300								
RL	0.1			0.25			0.5			0.1			0.25			0.5			0.1			0.25			0.5		
Rg [2]	0.1	0.25	0.5	0.25	0.5	1	0.5	1	2	0.1	0.25	0.5	0.25	0.5	1	0.5	1	2	0.1	0.25	0.5	0.25	0.5	1	0.5	1	2
Rd	0.37	0.44	0.44	1.1	1.18	1.4	2.18	2.6	2.7	0.44	0.5	0.5	1.1	1.18	1.4	2.45	2.9	2.7	0.44	0.5	0.53	1.18	1.18	1.45	2.45	2.9	2.95
Rc	1200	1100	1300	2400	2600	3600	4700	5500	5500	1000	750	800	1200	1600	2000	2600	3100	3500	500	450	600	1100	1200	1300	1700	2200	2300
Cd	0.05	0.05	0.05	0.03	0.03	0.025	0.02	0.05	0.02	0.05	0.05	0.05	0.04	0.04	0.04	0.03	0.025	0.02	0.07	0.07	0.06	0.04	0.04	0.05	0.04	0.04	0.04
Cc	5.2	5.3	4.8	3.7	3.2	2.5	2.3	2	2	6.5	6.7	6.7	5.2	4.3	3.8	3.2	2.5	2.8	8.5	8.3	8	5.5	5.4	5.8	4.2	4.1	4
C	0.02	0.01	0.006	0.008	0.005	0.003	0.005	0.0025	0.0015	0.02	0.01	0.006	0.008	0.005	0.0035	0.005	0.0025	0.0015	0.02	0.01	0.006	0.008	0.005	0.005	0.005	0.003	0.0025
Eo [3]	17	22	33	23	32	33	28	29	27	42	52	59	41	60	60	45	56	60	55	81	96	81	104	110	75	97	100
V.G. [4]	41	55	66	70	85	92	93	120	140	51	69	83	93	118	140	135	165	165	61	82	94	104	140	185	161	350	240

6L5-G:

(7)

Ebb [1]	90									180									300								
RL	0.05			0.1			0.25			0.05			0.1			0.25			0.05			0.1			0.25		
Rg [2]	0.05	0.1	0.25	0.1	0.25	0.5	0.25	0.5	1	0.05	0.1	0.25	0.1	0.25	0.5	0.25	0.5	1	0.05	0.1	0.25	0.1	0.25	0.5	0.25	0.5	1
Rc	2120	2500	2900	3510	4620	5200	8050	10300	12100	1810	2280	2660	3180	4200	4790	7100	9290	10950	1740	2160	2600	3070	4140	4700	6900	9100	10750
Cc	2.3	1.86	1.65	1.36	1.08	1	0.61	0.49	0.42	2.9	2.2	1.8	1.46	1.1	1	0.7	0.54	0.46	2.91	2.18	1.82	1.64	1.1	0.81	0.57	0.46	0.4
C	0.05	0.03	0.014	0.03	0.015	0.0085	0.0125	0.0085	0.0055	0.06	0.03	0.014	0.03	0.0145	0.009	0.014	0.009	0.0055	0.06	0.032	0.015	0.032	0.014	0.0075	0.013	0.0075	0.005
Eo [3]	14	18	21	16	22	23	18	22	24	32	41	46	36	46	50	38	46	52	56	68	79	60	79	89	64	80	88
V.G. [4]	9.3 [c]	10 [c]	11 [c]	11 [c]	12 [c]	12 [c]	12 [c]	12 [c]	12 [c]	10 [c]	11 [c]	12 [c]	12 [c]	12 [c]	12 [c]	12 [c]	12 [c]	13 [c]	11 [c]	12 [c]	12 [c]	12 [c]	13 [c]	13 [c]	13 [c]	13 [c]	13 [c]

6N7†, 6N7-G†, 6A6, 53:

(8)

Ebb [1]	90									180									300								
RL	0.1			0.25			0.5			0.1			0.25			0.5			0.1			0.25			0.5		
Rg [2]	0.1	0.25	0.5	0.25	0.5	1	0.5	1	2	0.1	0.25	0.5	0.25	0.5	1	0.5	1	2	0.1	0.25	0.5	0.25	0.5	1	0.5	1	2
Rc *	1900	2250	2500	4050	4950	5400	7000	8500	9650	1300	1700	1950	2950	3800	4300	5250	6600	7650	1150	1500	1750	2650	3400	4000	4850	6100	7150
C	0.025	0.01	0.006	0.01	0.006	0.003	0.006	0.003	0.0015	0.03	0.015	0.007	0.015	0.007	0.0035	0.007	0.0035	0.002	0.03	0.015	0.007	0.015	0.0055	0.003	0.0055	0.003	0.0015
Eo [3]	13	19	20	16	20	24	18	23	26	35	46	50	40	50	57	44	54	61	60	83	86	75	87	100	76	94	104
V.G. [4]	16	19	20	20	22	23	22	23	23	19	21	22	23	24	24	24	29	25	20	22	23	23	24	24	23	24	24

6Q7, 6Q7-G:

(9)

Ebb [1]	90									180									300								
RL	0.1			0.25			0.5			0.1			0.25			0.5			0.1			0.25			0.5		
Rg [2]	0.1	0.25	0.5	0.25	0.5	1	0.5	1	2	0.1	0.25	0.5	0.25	0.5	1	0.5	1	2	0.1	0.25	0.5	0.25	0.5	1	0.5	1	2
Rc	4000	4200	4300	7200	7600	8000	11500	12300	13700	1600	1900	2100	3400	4000	4500	6000	7100	7900	1200	1500	1700	2600	3000	3600	4600	5500	6200
Cc	2.07	1.7	1.5	1.17	1.2	0.9	0.72	0.6	0.45	3	2.5	2.3	1.6	1.3	1.05	0.86	0.76	0.63	4.4	3.6	3.05	2.4	1.66	1.45	1.2	0.9	0.9
C	0.02	0.01	0.005	0.01	0.006	0.003	0.006	0.003	0.0015	0.02	0.01	0.005	0.01	0.005	0.003	0.006	0.003	0.002	0.03	0.015	0.007	0.015	0.007	0.004	0.007	0.004	0.002
Eo [3]	5	8	9	8	11	13	9	13	17	19	26	29	25	31	37	30	36	41	35	52	53	43	52	62	47	60	66
V.G. [4]	23 [a]	28 [b]	29 [c]	31 [b]	32	33	31	33	37	28	33	35	36	38	40	39	40	41	34	39	40	42	45	45	45	46	47

6R7, 6R7-G:

(10)

Ebb [1]	90									180									300								
RL	0.05			0.1			0.25			0.05			0.1			0.25			0.05			0.1			0.25		
Rg [2]	0.05	0.1	0.25	0.1	0.25	0.5	0.25	0.5	1	0.05	0.1	0.25	0.1	0.25	0.5	0.25	0.5	1	0.05	0.1	0.25	0.1	0.25	0.5	0.25	0.5	1
Rc	2300	2600	2900	3500	4400	5000	7600	9800	11300	1700	2100	2500	3000	4100	4600	6700	8800	10000	1600	2000	2400	2900	3800	4400	6300	8400	10600
Cc	2	1.7	1.27	1.2	0.9	0.77	0.54	0.42	0.38	2.3	1.9	1.5	1.3	0.9	0.8	0.54	0.4	0.33	2.6	2	1.6	1.4	1.1	1	0.7	0.5	0.44
C	0.05	0.03	0.01	0.03	0.01	0.006	0.015	0.007	0.003	0.05	0.03	0.01	0.03	0.01	0.006	0.01	0.006	0.003	0.055	0.03	0.015	0.03	0.015	0.007	0.015	0.007	0.004
Eo [3]	14	18	20	15	19	21	15	18	21	31	40	45	35	43	46	33	40	47	50	62	71	52	68	71	54	62	74
V.G. [4]	8	9	10	10	10	11	10	11	11	9	9	10	10	10	10	10	10	11	9	9	10	10	10	10	10	11	11

6S7, 6S7-G:

(11)

Ebb [1]	90									180									300								
RL	0.1			0.25			0.5			0.1			0.25			0.5			0.1			0.25			0.5		
Rg [2]	0.1	0.25	0.5	0.25	0.5	1	0.5	1	2	0.1	0.25	0.5	0.25	0.5	1	0.5	1	2	0.1	0.25	0.5	0.25	0.5	1	0.5	1	2
Rd	0.59	0.65	0.7	1.5	1.6	1.7	3.2	3.5	3.7	0.58	0.68	0.71	1.6	1.8	1.9	3.3	3.6	3.8	0.59	0.67	0.71	1.7	1.95	2.1	3.6	3.9	4.1
Rc	870	900	910	1440	1520	1560	2620	2800	3000	530	540	540	850	890	950	1410	1520	1600	430	440	440	620	650	700	1000	1080	1120
Cd	0.065	0.061	0.057	0.044	0.044	0.043	0.029	0.03	0.031	0.073	0.07	0.065	0.05	0.044	0.046	0.041	0.037	0.031	0.077	0.071	0.071	0.058	0.057	0.055	0.04	0.041	0.043
Cc	5.1	5	4.58	3.38	3.23	3.22	2.04	1.95	1.92	7.2	6.9	6.6	4.6	4.7	4.4	3.5	3	2.9	8.5	8	8	6	5.8	5.2	4.1	3.9	3.8
C	0.018	0.01	0.007	0.007	0.0055	0.004	0.004	0.0026	0.0024	0.017	0.01	0.0063	0.0071	0.005	0.0037	0.0041	0.003	0.0024	0.0167	0.01	0.0066	0.0071	0.005	0.0036	0.0037	0.0029	0.0023
Eo [3]	16	21	23	14	18	19	12	15	16	33	43	48	33	40	44	30	38	42	57	75	82	54	66	76	52	66	73
V.G. [4]	33 [c]	47 [c]	54 [c]	56 [c]	66 [c]	77 [c]	70 [c]	84 [c]	94 [c]	47 [c]	66 [c]	75 [c]	79 [c]	104 [c]	118 [c]	109 [c]	134 [c]	147 [c]	57 [c]	78 [c]	89 [c]	98 [c]	122 [c]	136 [c]	136 [c]	162 [c]	178 [c]

—(Cont'd)

(12)

Ebb [1]	90									180									300								
RL	0.1			0.25			0.5			0.1			0.25			0.5			0.1			0.25			0.5		
Rg [2]	0.1	0.25	0.5	0.25	0.5	1	0.5	1	2	0.1	0.25	0.5	0.25	0.5	1	0.5	1	2	0.1	0.25	0.5	0.25	0.5	1	0.5	1	2
Rc	4350	4750	5050	7500	8300	9000	12500	14200	15500	2420	2830	3080	4410	5220	5920	7250	9440	10850	1950	2400	2640	3760	4580	5220	6570	8200	9600
Cc	1.8	1.5	1.43	1.12	1	0.88	0.67	0.6	0.54	2.55	2.25	2	1.5	1.25	1.11	0.91	0.74	0.6	2.85	2.55	2.25	1.57	1.35	1.23	1.02	0.82	0.7
C	0.023	0.012	0.007	0.012	0.0075	0.005	0.0065	0.0045	0.0035	0.023	0.0135	0.008	0.012	0.008	0.005	0.007	0.0045	0.0035	0.0245	0.0135	0.008	0.012	0.0075	0.005	0.008	0.0055	0.004
Eo [3]	5.6	7.8	8.5	7.7	10	12	9.4	12	13	21	29	32	27	34	39	31	39	43	44	58	64	57	69	80	62	77	86
V.G. [4]	20 [a]	24 [b]	25 [c]	28 [b]	30 [c]	32 [c]	31 [c]	33 [c]	34 [c]	24 [c]	28 [c]	31 [c]	34 [c]	36 [c]	38 [c]	38 [c]	41 [c]	41 [c]	27 [c]	32 [c]	33 [c]	37 [c]	40 [c]	41 [c]	42 [c]	43 [c]	44 [c]

6Z7-G†:

(13)

Ebb [1]	90									180									300								
RL	0.1			0.25			0.5			0.1			0.25			0.5			0.1			0.25			0.5		
Rg [2]	0.1	0.25	0.5	0.25	0.5	1	0.5	1	2	0.1	0.25	0.5	0.25	0.5	1	0.5	1	2	0.1	0.25	0.5	0.25	0.5	1	0.5	1	2
Rc *	1480	1760	1930	3000	3390	3670	5300	6050	6700	930	1100	1210	1820	2110	2400	3240	3890	4360	670	950	1050	1430	1680	1930	2540	3110	3560
Cc	2.65	2.02	1.7	1.36	1.1	0.8	0.65	0.61	0.45	3.4	2.6	2.32	1.71	1.38	1.1	0.9	0.703	0.553	3.81	2.63	2.34	1.87	1.46	1.19	0.97	0.72	0.56
C	0.025	0.0115	0.0065	0.01	0.006	0.0035	0.0055	0.003	0.0015	0.028	0.0115	0.007	0.012	0.007	0.0035	0.006	0.0035	0.002	0.028	0.012	0.007	0.012	0.006	0.0035	0.006	0.0035	0.002
Eo [3]	8	11	14	12	15	18	14	18	20	18	28	33	28	34	41	32	38	44	38	52	60	50	59	66	55	70	75
V.G. [4]	21 [c]	25	26	28	30	33	31	33	35	26	31	32	35	38	39	39	40	41	31	34	36	38	40	43	42	44	45

Data for **53**† tube will be found in chart No. **(8)**
Data for **55** tube will be found in chart No. **(17)**
Data for **56** tube will be found in chart No. **(15)**
Data for **57** tube will be found in chart No. **(6)**

(14)

Ebb [1]	90									180									300								
RL	0.1			0.25			0.5			0.1			0.25			0.5			0.1			0.25			0.5		
Rg [2]	0.1	0.25	0.5	0.25	0.5	1	0.5	1	2	0.1	0.25	0.5	0.25	0.5	1	0.5	1	2	0.1	0.25	0.5	0.25	0.5	1	0.5	1	2
Rc	6300	6600	6700	10000	11000	11500	16200	16600	17400	2600	2900	3000	4300	4800	5300	7000	8000	8800	1900	2200	2300	3300	3900	4200	5300	6100	7000
Cc	2.2	1.7	1.7	1.24	1.07	0.9	0.75	0.7	0.65	3.3	2.9	2.7	2.1	1.8	1.5	1.3	1.1	0.9	4	3.5	3	2.7	2	1.8	1.6	1.3	1.2
C	0.02	0.01	0.006	0.01	0.006	0.003	0.005	0.003	0.0015	0.025	0.015	0.007	0.015	0.007	0.004	0.007	0.004	0.002	0.03	0.015	0.007	0.015	0.007	0.004	0.007	0.004	0.002
Eo [3]	3	5	6	5	7	10	7	10	13	16	22	23	21	28	33	25	33	38	31	41	45	42	51	60	47	62	67
V.G. [4]	23 [d]	29 [b]	31 [c]	34 [b]	40 [c]	40	39	44	48	29	36	37	43	50	53	52	57	58	31	39	42	48	53	56	58	60	63

76, 56:

(15)

Ebb [1]	90									180									300								
RL	0.05			0.1			0.25			0.05			0.1			0.25			0.05			0.1			0.25		
Rg [2]	0.05	0.1	0.25	0.1	0.25	0.5	0.25	0.5	1	0.05	0.1	0.25	0.1	0.25	0.5	0.25	0.5	1	0.05	0.1	0.25	0.1	0.25	0.5	0.25	0.5	1
Rc	2500	3200	3800	4500	6500	7500	11100	15100	18300	2400	3000	3700	4500	6500	7600	10700	14700	17700	2400	3100	3800	4500	6400	7500	11100	15200	18300
Cc	2	1.6	1.25	1.05	0.82	0.68	0.48	0.36	0.32	2.5	1.9	1.65	1.45	0.97	0.8	0.6	0.45	0.4	2.8	2.2	1.8	1.6	1.2	0.98	0.69	0.5	0.4
C	0.06	0.03	0.015	0.03	0.015	0.007	0.015	0.007	0.0035	0.06	0.035	0.015	0.035	0.015	0.008	0.015	0.007	0.0045	0.08	0.045	0.02	0.04	0.02	0.009	0.02	0.009	0.005
Eo [3]	16	21	23	19	23	25	21	24	28	36	48	55	45	55	57	49	59	64	65	80	95	74	95	104	82	96	108
V.G. [4]	7	7.7	8.1	8.1	8.9	9.3	9.4	9.7	9.8	7.7	8.2	9	9.3	9.5	9.8	9.7	10	10	8.3	8.9	9.4	9.5	10	10	10	10	10

79†:

(16)

Ebb [1]	90									180									300								
RL	0.1			0.25			0.5			0.1			0.25			0.5			0.1			0.25			0.5		
Rg [2]	0.1	0.25	0.5	0.25	0.5	1	0.5	1	2	0.1	0.25	0.5	0.25	0.5	1	0.5	1	2	0.1	0.25	0.5	0.25	0.5	1	0.5	1	2
Rc *	2050	2200	2350	4000	4250	4650	6150	6850	7500	1050	1250	1350	2050	2450	2750	3450	4100	4650	800	1000	1100	1650	2050	2350	2850	3600	4450
C	0.04	0.015	0.009	0.015	0.006	0.004	0.006	0.004	0.002	0.04	0.02	0.009	0.02	0.01	0.005	0.009	0.0035	0.002	0.025	0.01	0.006	0.01	0.0055	0.003	0.0055	0.003	0.0015
Eo [3]	5.8	8.4	9.5	7.1	9.7	12	8.8	12	15	21	27	31	26	34	40	30	39	44	40	57	60	56	66	77	61	75	82
V.G. [4]	23 [b]	29 [c]	29	31 [c]	33	35	34	38	40	27	31	34	37	41	42	42	44	45	29	34	36	39	42	43	44	46	46

85, 55:

(17)

Ebb [1]	90									180									300								
RL	0.05			0.1			0.25			0.05			0.1			0.25			0.05			0.1			0.25		
Rg [2]	0.05	0.1	0.25	0.1	0.25	0.5	0.25	0.5	1	0.05	0.1	0.25	0.1	0.25	0.5	0.25	0.5	1	0.05	0.1	0.25	0.1	0.25	0.5	0.25	0.5	1
Rc	3800	4600	5400	6620	9000	10300	15100	20500	24400	3200	4100	5000	6200	8700	10000	14500	20000	24000	3200	4100	5100	5900	8300	9600	14300	19400	23600
Cc	1.4	1.1	0.86	0.7	0.55	0.5	0.31	0.25	0.2	1.8	1.6	1.2	0.9	0.7	0.57	0.43	0.29	0.24	1.9	1.5	1.2	0.8	0.54	0.43	0.3	0.22	0.2
C *	0.06	0.03	0.015	0.04	0.015	0.007	0.015	0.007	0.004	0.06	0.045	0.02	0.04	0.015	0.008	0.015	0.008	0.004	0.08	0.045	0.015	0.03	0.015	0.006	0.01	0.006	0.003
Eo [3]	16	19	23	17	22	25	18	23	26	33	44	49	37	47	50	40	48	53	50	74	85	64	82	88	71	84	94
V.G. [4]	4.5	4.9	5.1	5.1	5.4	5.5	5.3	5.5	5.6	4.9	5.2	5.3	5.3	5.5	5.5	5.6	5.7	5.7	5.2	5.5	5.6	5.5	5.7	5.8	5.7	5.7	5.8

‡The Cathodes of the Two Units Have Separate Terminals

†The Cathodes of the Two Units Have a Common Terminal

[1] Voltage at plate equals Plate-Supply voltage minus voltage drop in RL and Rc. For other supply voltages differing by as much as 50% from those listed, the values of resistors, condensers, and gain are approximately correct. The value of voltage output, however, for any of these other supply voltages equals the listed voltage output multiplied by the new plate-supply voltage divided by the plate-supply voltage corresponding to the listed voltage output.

[2] For following stage (see Circuit Diagrams).

[3] Voltage across Rg at grid-current point.

[4] Voltage Gain at 5 volts (RMS) output unless index letter indicates otherwise.

[a] At 2 volts (RMS) output.

[b] At 3 volts (RMS) output.

[c] At 4 volts (RMS) output.

[d] At 2.2 volts (RMS) output.

* Values are for phase-inverter service: See NOTES under RESISTANCE-COUPLED PHASE-INVERTER diagram.

LOGARITHMS, & LOGARITHMIC COMPUTATIONS*

COMPUTATIONS involving logarithms must be frequently made by radio men and those in the sound amplifier field in connection with problems concerning decibels.† A table of natural logarithms (base = 10) and a knowledge of its use is important in this work.

The Common System of Logarithms—Definitions

The basic idea underlying logarithms is that every positive number may be expressed as a power of some base.

The *logarithm* of a quantity is the exponent of the power to which a constant number (the *base*) must be raised in order to equal the quantity. The constant number is called the base. Since 10 is the base of our number systems, both integral and decimal, the base 10 has been chosen for a system of logarithms—the one called the *common system* or *Briggs' system.* When no other base is stated, the base is always understood to be 10.

The common logarithm of a number is therefore the power to which 10 must be raised to produce the given number. Thus, since $10^2 = 100$, that is, since 10 must be raised to the second power to equal 100, we say the logarithm of 100 is 2. This is written in abbreviated form *log 100 = 2.* The following table illustrates the connection between the power of ten and the logarithims of certain numbers:

Since:		Also, since:	
$10^0 = 1$,	log $1 = 0$	$10^{-1} = .1$,	log $.1 = -1$
$10^1 = 10$,	log $10 = 1$	$10^{-2} = .01$,	log $.01 = -2$
$10^2 = 100$,	log $100 = 2$	$10^{-3} = .001$,	log $.001 = -3$
$10^3 = 1000$,	log $1000 = 3$	$10^{-4} = .0001$,	log $.0001 = -4$

A study of the above table shows that only powers of 10 have integers for logarithms. The logarithm of any number which lies between 10 and 100, for example, has some value between 1 and 2; that is, it is 1 plus a decimal. Similarly, the logarithm of any number lying between 100 and 1000 has a value between 2 and 3, etc. Therefore, to represent all numbers it is necessary to utilize fractional powers. For example

$$\log 37 = 1.5682; \text{ that is, } 37 = 10^{1.5682}$$

$$\text{Also, } \log 461 = 2.6637; \text{ that is, } 461 = 10^{2.6637}$$

In the same manner, it follows that the logarithm of a number between 0.01 and 0.001 is —3 *plus* a decimal, or —2 *minus* a decimal. In order that the decimal part of a logarithm may always be positive, it has been agreed that the logarithm of a number less than 1 is to be taken so that the integral part only is negative. Thus, for a number such as .008 (which lies between .001 and .01) the logarithm lies between —3 and —2; that is, it is —3 plus a fraction. Thus, log .008 is $\bar{3}.90309$. The minus sign is placed above the 3 instead of in front of it, to show that the 3 only is negative, while the decimal part of the logarithm is always plus, or *positive.*

Characteristic and Mantissa, and Rules for Determining Them

From the foregoing, it follows that every logarithm has two parts, an integer and a decimal fraction.

The *integral* part of a logarithm is called the *characteristic,* and it may be positive or negative.

The *fractional* part is called the *mantissa,* and is *always positive.*

The characteristic of a logarithm is determined mentally by the following rule:

(1) *The characteristic of the logarithm of a number greater than 1 is positive, and is one less than the number of digits to the left of the decimal point.*

Thus, log 352.6 = 2.5473; that is, the characteristic of the logarithm of 352.6 is 2, because the number contains three figures to the left of the decimal point, namely 3, 5 and 2.

(2) *The characteristic of the logarithm of a positive number less than 1 is negative and is one more than the number of zeros between the decimal point and the first significant figure.*

Thus, log .00531 = $\bar{3}.7251$; that is, the characteristic of the logarithm of .00531 is $\bar{3}$, because there are 2 zeros between the decimal point and the first significant figure 5.

The mantissa (the fractional part of the logarithm) is the same for all numbers made up of the same significant figures, no matter where the decimal point is located. Hence, the mantissas of the logarithms of numbers up to certain limits have been computed by the use of advanced mathematics and arranged in published logarithmic tables for convenient reference. The one reproduced on the next page is a four-place table of logarithms, that is, the mantissas found there have been computed and rounded off to four decimal places.

Use of Tables to Find the Logarithm of a Given Number

Examination of the accompanying table shows that the first column is labeled **N** at the top and bottom. **N** is an abbreviation for "number." The other columns are labeled 0, 1, 2, 3, 4 . . . . . 9. Therefore, any number consisting of three significant figures has its first two

**Adapted from chapter on Logarithms in "Mathematics for Electricians" by Cooke, published by McGraw-Hill Book Co., New York.*

†For a discussion of the Decibel, and decibel calculation charts see Sect. 59 of this Handbook.

figures in the **N** column and its third figure in another column. This will be illustrated in the following examples.

When finding the logarithm of a number, *always write down the characteristic at once (see rule given previously), before looking for the mantissa.*

Example 1. Find the logarithm of 40.

Solution: Since there are two digits to the left of the decimal point, the characteristic is 1 less than 2, namely 1.

Since 40 has no third significant figure, other than zero, the mantissa of 40 is found at the right of 40 in the *N column*, in the column headed zero. It is .6021. Therefore log 40 = 1.6021.

TABLE OF COMMON LOGARITHMS*

N	0	1	2	3	4	5	6	7	8	9
0	....	0000	3010	4771	6021	6990	7782	8451	9031	9542
1	0000	0414	0792	1139	1461	1761	2041	2304	2553	2788
2	3010	3222	3424	3617	3802	3979	4150	4314	4472	4624
3	4771	4914	5051	5185	5315	5441	5563	5682	5798	5911
4	6021	6128	6232	6335	6435	6532	6628	6721	6812	6902
5	6990	7076	7160	7243	7324	7404	7482	7559	7634	7709
6	7782	7853	7924	7993	8062	8129	8195	8261	8325	8388
7	8451	8513	8573	8633	8692	8751	8808	8865	8921	8976
8	9031	9085	9138	9191	9243	9294	9345	9395	9445	9494
9	9542	9590	9638	9685	9731	9777	9823	9868	9912	9956
10	0000	0043	0086	0128	0170	0212	0253	0294	0334	0374
11	0414	0453	0492	0531	0569	0607	0645	0682	0719	0755
12	0792	0828	0864	0899	0934	0969	1004	1038	1072	1106
13	1139	1173	1206	1239	1271	1303	1335	1367	1399	1430
14	1461	1492	1523	1553	1584	1614	1644	1673	1703	1732
15	1761	1790	1818	1847	1875	1903	1931	1959	1987	2014
16	2041	2068	2095	2122	2148	2175	2201	2227	2253	2279
17	2304	2330	2355	2380	2405	2430	2455	2480	2504	2529
18	2553	2577	2601	2625	2648	2672	2695	2718	2742	2765
19	2788	2810	2833	2856	2878	2900	2923	2945	2967	2989
20	3010	3032	3054	3075	3096	3118	3139	3160	3181	3201
21	3222	3243	3263	3284	3304	3324	3345	3365	3385	3404
22	3424	3444	3464	3483	3502	3522	3541	3560	3579	3598
23	3617	3636	3655	3674	3692	3711	3729	3747	3766	3784
24	3802	3820	3838	3856	3874	3892	3909	3927	3945	3962
25	3979	3997	4014	4031	4048	4065	4082	4099	4116	4133
26	4150	4166	4183	4200	4216	4232	4249	4265	4281	4298
27	4314	4330	4346	4362	4378	4393	4409	4425	4440	4456
28	4472	4487	4502	4518	4533	4548	4564	4579	4594	4609
29	4624	4639	4654	4669	4683	4698	4713	4728	4742	4757
30	4771	4786	4800	4814	4829	4843	4857	4871	4886	4900
31	4914	4928	4942	4955	4969	4983	4997	5011	5024	5038
32	5051	5065	5079	5092	5105	5119	5132	5145	5159	5172
33	5185	5198	5211	5224	5237	5250	5263	5276	5289	5302
34	5315	5328	5340	5353	5366	5378	5391	5403	5416	5428
35	5441	5453	5465	5478	5490	5502	5514	5527	5539	5551
36	5563	5575	5587	5599	5611	5623	5635	5647	5658	5670
37	5682	5694	5705	5717	5729	5740	5752	5763	5775	5786
38	5798	5809	5821	5832	5843	5855	5866	5877	5888	5899
39	5911	5922	5933	5944	5955	5966	5977	5988	5999	6010
40	6021	6031	6042	6053	6064	6075	6085	6096	6107	6117
41	6128	6138	0149	6160	6170	6180	6191	6201	6212	6222
42	6232	6243	0253	6263	6274	6284	6294	6304	6314	6325
43	6335	6345	0355	6365	6375	6385	6395	6405	6415	6425
44	6435	6444	6454	6464	6474	6484	6493	6503	6513	6522
45	6532	6542	6551	6561	6571	6580	6590	6599	6609	6618
46	6628	6637	6646	6656	6665	6675	6684	6693	6702	6712
47	6721	6730	6739	6749	6758	6767	6776	6785	6794	6803
48	6812	6821	6830	6839	6848	6857	6866	6875	6884	6893
49	6902	6911	6920	6928	6937	6946	6955	6964	6972	6981
50	6990	6998	7007	7016	7024	7033	7042	7050	7059	7067
N	0	1	2	3	4	5	6	7	8	9

N	0	1	2	3	4	5	6	7	8	9
50	6990	6998	7007	7016	7024	7033	7042	7050	7059	7067
51	7076	7084	7093	7101	7110	7118	7126	7135	7143	7152
52	7160	7168	7177	7185	7193	7202	7210	7218	7226	7235
53	7243	7251	7259	7267	7275	7284	7292	7300	7308	7316
54	7324	7332	7340	7348	7356	7364	7372	7380	7388	7396
55	7404	7412	7419	7427	7435	7443	7451	7459	7466	7474
56	7482	7490	7497	7505	7513	7520	7528	7536	7543	7551
57	7559	7566	7574	7582	7589	7597	7604	7612	7619	7627
58	7634	7642	7649	7657	7664	7672	7679	7686	7694	7701
59	7709	7716	7723	7731	7738	7745	7752	7760	7767	7774
60	7782	7789	7796	7803	7810	7818	7825	7832	7839	7846
61	7853	7860	7868	7875	7882	7889	7896	7903	7910	7917
62	7924	7931	7938	7945	7952	7959	7966	7973	7980	7987
63	7993	8000	8007	8014	8021	8028	8035	8041	8048	8055
64	8062	8069	8075	8082	8089	8096	8102	8109	8116	8122
65	8129	8136	8142	8149	8156	8162	8169	8176	8182	8189
66	8195	8202	8209	8215	8222	8228	8235	8241	8248	8254
67	8261	8267	8274	8280	8287	8293	8299	8306	8312	8319
68	8325	8331	8338	8344	8351	8357	8363	8370	8376	8382
69	8388	8395	8401	8407	8414	8420	8426	8432	8439	8445
70	8451	8457	8463	8470	8476	8482	8488	8494	8500	8506
71	8513	8519	8525	8531	8537	8543	8549	8555	8561	8567
72	8573	8579	8585	8591	8597	8603	8609	8615	8621	8627
73	8633	8639	8645	8651	8657	8663	8669	8675	8681	8686
74	8692	8698	8704	8710	8716	8722	8727	8733	8739	8745
75	8751	8756	8762	8768	8774	8779	8785	8791	8797	8802
76	8808	8814	8820	8825	8831	8837	8842	8848	8854	8859
77	8865	8871	8876	8882	8887	8893	8899	8904	8910	8915
78	8921	8927	8932	8938	8943	8949	8954	8960	8965	8971
79	8976	8982	8987	8993	8998	9004	9009	9015	9020	9025
80	9031	9036	9042	9047	9053	9058	9063	9069	9074	9079
81	9085	9090	9096	9101	9106	9112	9117	9122	9128	9133
82	9138	9143	9149	9154	9159	9165	9170	9175	9180	9186
83	9191	9196	9201	9206	9212	9217	9222	9227	9232	9238
84	9243	9248	9253	9258	9263	9269	9274	9279	9284	9289
85	9294	9299	9304	9309	9315	9320	9325	9330	9335	9340
86	9345	9350	9355	9360	9365	9370	9375	9380	9385	9390
87	9395	9400	9405	9410	9415	9420	9425	9430	9435	9440
88	9445	9450	9455	9460	9465	9469	9474	9479	9484	9489
89	9494	9499	9504	9509	9513	9518	9523	9528	9533	9538
90	9542	9547	9552	9557	9562	9566	9571	9576	9581	9586
91	9590	9595	9600	9605	9609	9614	9619	9624	9628	9633
92	9638	9643	9647	9652	9657	9661	9666	9671	9675	9680
93	9685	9689	9694	9699	9703	9708	9713	9717	9722	9727
94	9731	9736	9741	9745	9750	9754	9759	9763	9768	9773
95	9777	9782	9786	9791	9795	9800	9805	9809	9814	9818
96	9823	9827	9832	9836	9841	9845	9850	9854	9859	9863
97	9868	9872	9877	9881	9886	9890	9894	9899	9903	9908
98	9912	9917	9921	9926	9930	9934	9939	9943	9948	9952
99	9956	9961	9965	9969	9974	9978	9983	9987	9991	9996
100	0000	0004	0009	0013	0017	0022	0026	0030	0035	0039
N	0	1	2	3	4	5	6	7	8	9

Reprinted by permission from "Mathematics For Electricians" by Cooke, published by McGraw-Hill Book Co., New York.

Example 2. Find log 416.

Solution: The characteristic is 2. The first two digits of 416 are found in the N column and the third digit in the column headed 6. Therefore the mantissa is read in the row containing 41 and the column headed 6. It is 0.6191. Therefore log 416 = 2.6191.

Similarly, log 4.16 = 0.6191; log 41.6 = 1.6191; log 4160 = 3.6191; log 0.00416 = $\bar{3}$.6191, etc.

Example 3. Find log 4347.

Solution: The characteristic is 3. Since the number 4347 is between the numbers 4340 and 4350, its mantissa must be some value between the mantissa of 4340 and 4350. From the table,

Mantissa of 4350 = 0.6385
Mantissa of 4340 = 0.6375
Difference = 0.0010

Thus the *tabular difference* between these mantissas is 0.0010, and it is apparent that an *increase* of 10 in the number causes thet mantissa to *increase* by 0.0010. Therefore, assuming that the increase in the logarithm is proportional to the increase in the number, an increase of 7 in the number will increase the mantissa 7/10 as much. Hence the increase in the mantissa will be $0.0010 \times 0.7 = 0.0007$, and the mantissa of 4347 will be 0.6375 + 0.0007 = 0.6382.

Therefore, log 4347. = 3.6382

Similarly, log 43.47 = 1.6382; log 4.347 = 0.6382; log 434,700 = 5.6382; log 0.0004347 = $\bar{4}$.6382, etc.

Example 4. Find the logarithm of 0.000042735

Solution: The characteristic is $\bar{5}$ because there are four zeros between the decimal point and the first significant figure. To find the mantissa, we proceed as though 42735 were an integral number. Since 42,735 is between 32700 and 42800, its mantissa must lie between the mantissa of 42,700 and 42,800.

Mantissa of 42,800 = 0.6314
Mantissa of 42,700 = 0.6304
Tabular difference = 0.0010

Since an increase of 100 in the number causes the mantissa to increase 0.0010, an increase of 35 in the number would cause an increase of $0.0010 \times 0.35 = 0.000350$ in the mantissa. Then the mantissa of 42,735 will be

$$0.6304 + 0.000350 = 0.630750$$

Dropping off everything past the 4th signicant figure (4 place table used), we have, log 0.000052735 = $\bar{5}$.6308.

To Find the Number Corresponding to a Given Logarithm

The number corresponding to a given logarithm is called the *antilogarithm,* and is written *antilog.* For example, if log 692 = 2.8401, then the number corresponding to the logarithm 2.8401 is 692. That is, antilog 2.8401 = 692.

To find the antilog of a given logarithm, we reverse the process described here for finding the logarithm when the number is given.

Example 1. Find the number whose logarithm is 3.9101.

Solution: The characteristic tells only the position of the decimal point. Therefore, to find the significant figures of the number (antilog), the mantissa must be found in the accompanying table of logarithms. To the left of the mantissa 0.9101, in column N, find the first two significant figures of the number, which are 81; and, at the head of the column of the mantissa, find the third significant figure, which is 3. Hence the number has the significant figures 813. The position of the decimal point is fixed by the characteristic; and because the characteristic is 3, there must be four figures to the left of the decimal point.

Thus, antilog 3.9101 = 8130
Similarly, antilog $\bar{1}$.9101 = 8.13
antilog $\bar{3}$.9101 = 0.00813
antilog 6.9101 = 8,130,000, etc.

A change in the characteristic changes only the position of the decimal point.

Example 2. Find the number whose logarithm is 2.3680.

Solution: Examination of the accompanying table of logarithms shows that the mantissa of the logarithm is not given exactly there.

Find the two consecutive mantissas between which the given mantissa lies. These are 0.3674 and 0.3692. Then, considering only significant figures,

0.3692 = mantissa of log 234
0.3674 = mantissa of log 233
Tabular difference = 0.0018, number difference = 1

Hence a difference of 0.0018 in the mantissa makes a difference of 1 in the number. Now the given mantissa is 0.0006 larger than the smaller one (0.3680 — 0.3674 = 0.0006). Then the required number is

$$\frac{0.0006}{0.0018} \times 1 = 0.33$$

larger than 233. The sequence of significant figures is 233.33 or 233.3, for results were computed from a four-place table.

$\therefore$ antilog 2.3680 = 233.3
or 2.3680 = log 233.3

Example 3. Find the number whose logarithm is $\bar{4}$.9793.

Solution:
0.9795 = mantissa of log 954
0.9791 = mantissa of log 953
Tabular difference = 0.0004, number difference = 1

Given mantissa = 0.9793
Next lower mantissa = 0.9791
Difference = 0.0002

Since the difference between numbers is proportional to the difference of the corresponding mantissa, the fourth significant figure to be added to 953 is

$$\frac{0.0002}{0.0004} \times 1 = 0.5$$

The required significant figures are 953.5.

$\therefore$ antilog $\bar{4}$.9793 = 0.0009535
$= 9.535 \times 10^{-4}$
or $\bar{4}.9793 = \log 9.535 \times 10^{-4}$

Addition and Subtraction of Logarithms

Since the mantissa of a logarithm is always positive, care must be exercised in adding or subtracting logarithms.

Adding logarithms with *positive* characteristics is the same as adding arithmetical numbers.

Example 1. Add the logarithms 2.7642 and 4.3046.

Solution:

$$\begin{array}{r} 2.7642 \\ 4.3046 \\ \hline 7.0688 \end{array}$$

To add logarithms whose characteristics are both *negative,* proceed as follows:

Example 2. Add the logarithms $\bar{4}.3265$ and $\bar{6}.2843$.

Solution:

$$\begin{array}{r} \bar{4}.3265 \\ \bar{6}.2843 \\ \hline \bar{10}.6108 = .6108 \end{array}$$

To add logarithms with *negative* characteristics to those with *positive* characteristics proceed as follows:

Example 3. Add the logarithms $\bar{4}.3265$ and 6.2843.

Solution:

$$\begin{array}{r} \bar{4}.3265 \\ 6.2843 \\ \hline 2.6108 \end{array}$$

To subtract a logarithm from a smaller one, proceed as follows:

Example 4. Subtract the logarithm 6.9860 from the logarithm 4.1073.

Solution: Add 10 to the characteristic of the smaller logarithm, thus, $4.1073 + 10 = 14.1073$

$$\begin{array}{rr} \text{then} & 14.1073 \\ & 6.9860 \\ \hline & 7.1213 \end{array}$$

Now subtract 10 from the characteristic of the result, to preserve equality, thus, $7.1213 - 10 = \bar{3}.1213$ *Ans.*

DECIBEL—POWER RATIO—VOLTAGE RATIO—CURRENT RATIO CONVERSION TABLE

IT is convenient in measurements and calculations on communications systems to express the ratio between any two amounts of electric or acoustic power in units on a logarithmic scale. The *decibel* (1/10th of the *bel*) on the briggsian or base-10 scale and the *neper* on the napierian or base-*e* scale are in almost universal use for this purpose.

The Decibel

The decibel is a unit of *power ratio*. The number of decibels (db) corresponding to a given power ratio P_1/P_2 is 10 times the common logarithm* of the ratio.

Thus:

$$db = 10 \log_{10} \frac{P_1}{P_2} \qquad (1)$$

In the case of two voltages E_1 and E_2, or two currents I_1 and I_2, operating into the same or equal impedances, the number of decibels corresponds to 20 times the common logarithm of the ratio. Thus:

$$db = 20 \log_{10} \frac{E_1}{E_2} \qquad (2)$$

$$\text{and } db = 20 \log_{10} \frac{I_1}{I_2} \qquad (3)$$

If E_1 and E_2 or I_1 and I_2 operate in unequal impedances,

$$db = 20 \log_{10} \frac{E_1}{E_2} + 10 \log_{10} \frac{Z_2}{Z_1} + 10 \log_{10} \frac{k_1}{k_2} \qquad (4)$$

$$\text{and } db = 20 \log_{10} \frac{I_1}{I_2} + 10 \log_{10} \frac{Z_1}{Z_2} + 10 \log_{10} \frac{k_1}{k_2} \qquad (5)$$

where Z_1 and Z_2 are the absolute magnitudes of the corresponding impedances and k_1 and k_2 are the values of power factor for the impedances. The *Conversion Table* on the following page can be used to evaluate the impedance and power factor terms, since both are similar to the expression for power ratio, equation (*1*).

The Neper

Neper—The number of nepers N_{nep} corresponding to a power ratio $\frac{P_1}{P_2}$ is

$$N_{nep} = \frac{1}{2} \log_e \frac{P_1}{P_2} \qquad (6)$$

For voltage ratios $\frac{E_1}{E_2}$ or current ratios $\frac{I_1}{I_2}$ working in the same or equal impedances,

$$N_{nep} = \log_e \frac{E_1}{E_2} \qquad (7)$$

$$\text{and } N_{nep} = \log_e \frac{I_1}{I_2}$$

When E_1 and E_2 or I_1 and I_2 operate in unequal impedances,

$$N_{nep} = \log_e \frac{E_1}{E_2} + \frac{1}{2} log_e \frac{Z_2}{Z_1} + \frac{1}{2} log_e \frac{k_1}{k_2} \qquad (8)$$

and

$$N_{nep} = \log_e \frac{I_1}{I_2} + \frac{1}{2} log_e \frac{Z_1}{Z_2} + \frac{1}{2} log_e \frac{k_1}{k_2} \qquad (9)$$

where Z_1 and Z_2 and k_1 and k_2 are as in equations (*4*) and (*5*).

RELATIONS BETWEEN DECIBELS, NEPERS, AND MILES OF STANDARD CABLE

Multiply	*By*	*To Find*
decibels	.1151	nepers
decibels	1.056	miles of standard cable
miles of standard cable	.947	decibels
miles of standard cable	.109	nepers
nepers	8.686	decibels
nepers	9.175	miles of standard cable

Since voltage and current are related to power by impedance, both the *decibel* and the *neper* can be used to express voltage and current ratios, if care is taken to account for the impedances associated with them. In a similar manner the corresponding acoustical quantities can be compared.

The *Decibel Conversion Table* on the following pages has been prepared to facilitate making conversions in either direction between the number of *decibels* and the corresponding power, voltage, and current ratios. It can also be used for *nepers* and the *mile of standard cable* by applying the conversion factors from the table in the column at the right-hand side of this page.

For Decibel Conversion Table see next 2 pages.

*For an explanation of logarithms and a table of logarithms see Sect. 58 of this Handbook.

DECIBEL—POWER RATIO-VOLTAGE RATIO—CURRENT RATIO—CONVERSION TABLE*

(A) To find the number of Decibels equivalent to a given *power* loss or gain ratio, first locate the given ratio in the proper (loss, or gain) *Power Ratio* column of the table; then read the corresponding number of Decibels in the *db* column.

Example: What is the gain, expressed in decibels, if the power output of an amplifier is increased 50 times?

Solution: Since this is a power *gain* ratio, look up the number 50 in the right hand *Power Ratio* column. The closest listed number is 50.12. This is equivalent to a *gain* of 17.0 db.

(B) To find the number of Decibels equivalent to a given *voltage* loss or gain ratio, locate the given ratio in the proper (loss, or gain) *Voltage Ratio* column; then read the corresponding number of Decibels in the **db** column.

Example: What is the gain, in db, if the *voltage* is made 5 times as large?

Solution: Since this is a *voltage gain*, look up the number 5 in the right hand *Voltage Ratio* column. The closest listed number is 5.012, which is equivalent to a *gain* of 14.0 db.

(C) To find the *Power* loss or gain *Ratio* equivalent to a given number of Decibels, locate the given number of decibels in the **db** column; then read the corresponding power loss or gain ratio in the proper (loss, or gain) *Power Ratio* column.

Example: What is the power loss ratio corresponding to a loss of 15 db?

Solution: Look up the number 15 in the db column, and since this is a power *loss* ratio, refer to the Power Ratio *loss* column to the left. The Power *Loss* Ratio is 0.03162.

(D) To find the *Current* or *Voltage* loss or gain *Ratio* equivalent to a given number of Decibels, locate the given number of decibels in the *db* column; then read the corresponding current or voltage loss or gain ratio in the proper (loss, or gain) *Voltage Ratio* column.

Example: What is the voltage gain ratio corresponding to a gain of 15 db?

Solution: Look up the number 15 in the db column. Referring across to the right we see that this is equivalent to a voltage *gain* ratio of 5.623.

To Find Values Outside the Range of the Table

Values outside the range of the table can be readily found with the help of the following simple rules:

(A) Given: *Number of Decibels Positive* (+)

To Find: *Power* or *Voltage Ratio*

First, subtract +20 decibels successively from the given number of decibels until the remainder falls within range of the Table. Look this decibel value up in the table. Then, *to find the voltage gain ratio,* multiply the corresponding value in the right-hand Voltage-Ratio column by 10 for each time you subtracted 20 db. *To find the power gain ratio,* multiply the corresponding value in the right hand Power Ratio Ratio column by 100 for each time you subtracted 20 db.

Example—*Given*: +49.2 db (gain)
—*Find*: the *Voltage Ratio* and *Power Ratio*

Solution:

+49.2 db. — 20 db — 20 db = +9.2 db

The value of 9.2 db lies within the range of the table and therefore the *gain* Voltage Ratio and *gain* Power Ratio for it can be looked up in the table. They are 2.884 and 8.318 respectively. We have then:

Voltage gain ratio = 2.884 × 10 × 10 = 288.4
Power gain ratio = 8.318 × 100 × 100 = 83,180

(B) Given: *Number of Decibels Negative* (—)

To Find: *Power* or *Voltage Ratio*

First, add +20 decibels successively to the given number of decibels until the sum falls within the range of the Table. Then look this decibel value up in the table. Then, *to find*

(Cont'd over)

loss ← −db+ → gain				
Voltage Ratio	*Power Ratio*	*db*	*Voltage Ratio*	*Power Ratio*
1.0000	1.0000	0	1.000	1.000
.9886	.9772	.1	1.012	1.023
.9772	.9550	.2	1.023	1.047
.9661	.9333	.3	1.035	1.072
.9550	.9120	.4	1.047	1.096
.9441	.8913	.5	1.059	1.122
.9333	.8710	.6	1.072	1.148
.9226	.8511	.7	1.084	1.175
.9120	.8318	.8	1.096	1.202
.9016	.8128	.9	1.109	1.230
.8913	.7943	1.0	1.122	1.259
.8810	.7762	1.1	1.135	1.288
.8710	.7586	1.2	1.148	1.318
.8610	.7413	1.3	1.161	1.349
.8511	.7244	1.4	1.175	1.380
.8414	.7079	1.5	1.189	1.413
.8318	.6918	1.6	1.202	1.445
.8222	.6761	1.7	1.216	1.479
.8128	.6607	1.8	1.230	1.514
.8035	.6457	1.9	1.245	1.549
.7943	.6310	2.0	1.259	1.585
.7852	.6166	2.1	1.274	1.622
.7762	.6026	2.2	1.288	1.660
.7674	.5888	2.3	1.303	1.698
.7586	.5754	2.4	1.318	1.738
.7499	.5623	2.5	1.334	1.778
.7413	.5495	2.6	1.349	1.820
.7328	.5370	2.7	1.365	1.862
.7244	.5248	2.8	1.380	1.905
.7161	.5129	2.9	1.396	1.950

—(Cont'd)

loss ← −db+ → gain				
Voltage Ratio	*Power Ratio*	*db*	*Voltage Ratio*	*Power Ratio*
.7079	.5012	3.0	1.413	1.995
.6998	.4898	3.1	1.429	2.042
.6918	.4786	3.2	1.445	2.089
.6839	.4677	3.3	1.462	2.138
.6761	.4571	3.4	1.479	2.188
.6683	.4467	3.5	1.496	2.239
.6607	.4365	3.6	1.514	2.291
.6531	.4266	3.7	1.531	2.344
.6457	.4169	3.8	1.549	2.399
.6383	.4074	3.9	1.567	2.455
.6310	.3981	4.0	1.585	2.512
.6237	.3890	4.1	1.603	2.570
.6166	.3802	4.2	1.622	2.630
.6095	.3715	4.3	1.641	2.692
.6026	.3631	4.4	1.660	2.754
.5957	.3548	4.5	1.679	2.818
.5888	.3467	4.6	1.698	2.884
.5821	.3388	4.7	1.718	2.951
.5754	.3311	4.8	1.738	3.020
.5689	.3236	4.9	1.758	3.090
.5623	.3162	5.0	1.778	3.162
.5559	.3090	5.1	1.799	3.236
.5495	.3020	5.2	1.820	3.311
.5433	.2951	5.3	1.841	3.388
.5370	.2884	5.4	1.862	3.467
.5309	.2818	5.5	1.884	3.548
.5248	.2754	5.6	1.905	3.631
.5188	.2692	5.7	1.928	3.715
.5129	.2630	5.8	1.950	3.802
.5070	.2570	5.9	1.972	3.890

—(Cont'd)

loss ← −db+ → gain				
Voltage Ratio	*Power Ratio*	*db*	*Voltage Ratio*	*Power Ratio*
.5012	.2512	6.0	1.995	3.981
.4955	.2455	6.1	2.018	4.074
.4898	.2399	6.2	2.042	4.169
.4842	.2344	6.3	2.065	4.266
.4786	.2291	6.4	2.089	4.365
.4732	.2239	6.5	2.113	4.467
.4677	.2188	6.6	2.138	4.571
.4624	.2138	6.7	2.163	4.677
.4571	.2089	6.8	2.188	4.786
.4519	.2042	6.9	2.213	4.898
.4467	.1995	7.0	2.239	5.012
.4416	.1950	7.1	2.265	5.129
.4365	.1905	7.2	2.291	5.248
.4315	.1862	7.3	2.317	5.370
.4266	.1820	7.4	2.344	5.495
.4217	.1778	7.5	2.371	5.623
.4169	.1738	7.6	2.399	5.754
.4121	.1698	7.7	2.427	5.888
.4074	.1660	7.8	2.455	6.026
.4027	.1622	7.9	2.483	6.166
.3981	.1585	8.0	2.512	6.310
.3936	.1549	8.1	2.541	6.457
.3890	.1514	8.2	2.570	6.607
.3846	.1479	8.3	2.600	6.761
.3802	.1445	8.4	2.630	6.918
.3758	.1413	8.5	2.661	7.079
.3715	.1380	8.6	2.692	7.244
.3673	.1349	8.7	2.723	7.413
.3631	.1318	8.8	2.754	7.586
.3589	.1288	8.9	2.786	7.762

(Cont'd on next page)

*Note: *Table reprinted here by permission of the Engineering Department of the General Radio Company.*

—(Cont'd)

loss ← −db+ → gain				
Voltage Ratio	Power Ratio	db	Voltage Ratio	Power Ratio
.3548	.1259	9.0	2.818	7.943
.3508	.1230	9.1	2.851	8.128
.3467	.1202	9.2	2.884	8.318
.3428	.1175	9.3	2.917	8.511
.3388	.1148	9.4	2.951	8.710
.3350	.1122	9.5	2.985	8.913
.3311	.1096	9.6	3.020	9.120
.3273	.1072	9.7	3.055	9.333
.3236	.1047	9.8	3.090	9.550
.3199	.1023	9.9	3.126	9.772
.3162	.1000	10.0	3.162	10.000
.3126	.09772	10.1	3.199	10.23
.3090	.09550	10.2	3.236	10.47
.3055	.09333	10.3	3.273	10.72
.3020	.09120	10.4	3.311	10.96
.2985	.08913	10.5	3.350	11.22
.2951	.08710	10.6	3.388	11.48
.2917	.08511	10.7	3.428	11.75
.2884	.08318	10.8	3.467	12.02
.2851	.08128	10.9	3.508	12.30
.2818	.07943	11.0	3.548	12.59
.2786	.07762	11.1	3.589	12.88
.2754	.07586	11.2	3.631	13.18
.2723	.07413	11.3	3.673	13.49
.2692	.07244	11.4	3.715	13.80
.2661	.07079	11.5	3.758	14.13
.2630	.06918	11.6	3.802	14.45
.2600	.06761	11.7	3.846	14.79
.2570	.06607	11.8	3.890	15.14
.2541	.06457	11.9	3.936	15.49
.2512	.06310	12.0	3.981	15.85
.2483	.06166	12.1	4.027	16.22
.2455	.06026	12.2	4.074	16.60
.2427	.05888	12.3	4.121	16.98
.2399	.05754	12.4	4.169	17.38
.2371	.05623	12.5	4.217	17.78
.2344	.05495	12.6	4.266	18.20
.2317	.05370	12.7	4.315	18.62
.2291	.05248	12.8	4.365	19.05
.2265	.05129	12.9	4.416	19.50
.2239	.05012	13.0	4.467	19.95
.2213	.04898	13.1	4.519	20.42
.2188	.04786	13.2	4.571	20.89
.2163	.04677	13.3	4.624	21.38
.2138	.04571	13.4	4.677	21.88
.2113	.04467	13.5	4.732	22.39
.2089	.04365	13.6	4.786	22.91
.2065	.04266	13.7	4.842	23.44
.2042	.04169	13.8	4.898	23.99
.2018	.04074	13.9	4.955	24.55
.1995	.03981	14.0	5.012	25.12
.1972	.03890	14.1	5.070	25.70
.1950	.03802	14.2	5.129	26.30
.1928	.03715	14.3	5.188	26.92
.1905	.03631	14.4	5.248	27.54
.1884	.03548	14.5	5.309	28.18
.1862	.03467	14.6	5.370	28.84
.1841	.03388	14.7	5.433	29.51
.1820	.03311	14.8	5.495	30.20
.1799	.03236	14.9	5.559	30.90
.1778	.03162	15.0	5.623	31.62
.1758	.03090	15.1	5.689	32.36
.1738	.03020	15.2	5.754	33.11
.1718	.02951	15.3	5.821	33.88
.1698	.02884	15.4	5.888	34.67
.1679	.02818	15.5	5.957	35.48
.1660	.02754	15.6	6.026	36.31
.1641	.02692	15.7	6.095	37.15
.1622	.02630	15.8	6.166	38.02
.1603	.02570	15.9	6.237	38.90

—(Cont'd)

—(Cont'd)

loss ← −db+ → gain				
Voltage Ratio	Power Ratio	db	Voltage Ratio	Power Ratio
.1585	.02512	16.0	6.310	39.81
.1567	.02455	16.1	6.383	40.74
.1549	.02399	16.2	6.457	41.69
.1531	.02344	16.3	6.531	42.66
.1514	.02291	16.4	6.607	43.65
.1496	.02239	16.5	6.683	44.67
.1479	.02188	16.6	6.761	45.71
.1462	.02138	16.7	6.839	46.77
.1445	.02089	16.8	6.918	47.86
.1429	.02042	16.9	6.998	48.98
.1413	.01995	17.0	7.079	50.12
.1396	.01950	17.1	7.161	51.29
.1380	.01905	17.2	7.244	52.48
.1365	.01862	17.3	7.328	53.70
.1349	.01820	17.4	7.413	54.95
.1334	.01778	17.5	7.499	56.23
.1318	.01738	17.6	7.586	57.54
.1303	.01698	17.7	7.674	58.88
.1288	.01660	17.8	7.762	60.26
.1274	.01622	17.9	7.852	61.66
.1259	.01585	18.0	7.943	63.10
.1245	.01549	18.1	8.035	64.57
.1230	.01514	18.2	8.128	66.07
.1216	.01479	18.3	8.222	67.61
.1202	.01445	18.4	8.318	69.18
.1189	.01413	18.5	8.414	70.79
.1175	.01380	18.6	8.511	72.44
.1161	.01349	18.7	8.610	74.13
.1148	.01318	18.8	8.710	75.86
.1135	.01288	18.9	8.811	77.62
.1122	.01259	19.0	8.913	79.43
.1109	.01230	19.1	9.016	81.28
.1096	.01202	19.2	9.120	83.18
.1084	.01175	19.3	9.226	85.11
.1072	.01148	19.4	9.333	87.10
.1059	.01122	19.5	9.441	89.13
.1047	.01096	19.6	9.550	91.20
.1035	.01072	19.7	9.661	93.33
.1023	.01047	19.8	9.772	95.50
.1012	.01023	19.9	9.886	97.72
.1000	.01000	20.0	10.000	100.00

loss ← −db+ → gain				
Voltage Ratio	Power Ratio	db	Voltage Ratio	Power Ratio
3.162×10^{-1}	10^{-1}	10	3.162	10
10^{-1}	10^{-2}	20	10	10^2
3.162×10^{-2}	10^{-3}	30	3.162×10	10^3
10^{-2}	10^{-4}	40	10^2	10^4
3.162×10^{-3}	10^{-5}	50	3.162×10^2	10^5
10^{-3}	10^{-6}	60	10^3	10^6
3.162×10^{-4}	10^{-7}	70	3.162×10^3	10^7
10^{-4}	10^{-8}	80	10^4	10^8
3.162×10^{-5}	10^{-9}	90	3.162×10^4	10^9
10^{-5}	10^{-10}	100	10^5	10^{10}

(To find decibel values outside the range of Table see instructions at the beginning of the table.)

—(Cont'd)

the voltage loss ratio, divide the corresponding value in the left-hand Voltage-Ratio column by 10 for each time you added 20 db. *To find the power loss ratio*, divide the corresponding value in the left-hand Power-Ratio column by 100 for each time you added 20 db.

Example:

—*Given*: —49.2 db (*loss*)

—*Find*: the *Voltage Ratio* and *Power Ratio*

Solution:

$$-49.2 \text{ db} + 20 \text{ db} + 20 \text{ db} = -9.2 \text{ db}$$

The value of 9.2 db lies within the range of the table, and therefore the *loss* Voltage Ratio and *loss* Power Ratio for it can be looked up on the table. They are .3467 and .1202 respectively. We have then:

Voltage loss ratio =

$$.3467 \times 1/10 \times 1/10 = .003467$$

Power loss ratio =

$$.1202 \times 1/100 \times 1/100 = .00001202$$

Caution:

The decibel being a unit of power *ratio*, it is necessary to specify the reference level when stating performance indices of radio equipment in *decibels*. To state that the power output of an amplifier is 60 decibels is meaningless unless a reference level is also stated, as for example *60 db above one milliwatt*. In this respect, the industry is guilty of loose usage of the decibel as an index of performance of equipment, and one repeatedly sees microphone sensitivities, phonograph pickup outputs, amplifier hum and noise, amplifier outputs, and line power levels specified in db without mentioning a reference level. In all such cases a reference level is implied, but since many of them are not yet standardized, the figures given are, to say the least, without definite meaning.

Sound levels, intensity levels, loudness levels and noise levels may be correctly stated in db without mentioning the reference level, since for acoustic work, zero level of intensity has been standardized (*at 10^{-16} acoustic watts per square centimeter*).

WAVELENGTH—FREQUENCY—L×C CONVERSION TABLE

THE relation between the *wavelength* in meters and the *frequency* of electromagnetic waves is given by the equations:

$$Wavelength\ (meters) = \frac{300{,}000{,}000}{Frequency\ (cycles)}$$

$$= \frac{300{,}000}{Frequency\ (kc)} = \frac{300}{Frequency\ (megacycles)}$$

Conversely:

$$Frequency\ (kc) = \frac{300{,}000}{Wavelength\ (meters)}$$

$$Frequency\ (megacycles) = \frac{300}{Wavelength\ (meters)};\ etc.$$

Rapid conversion of *wavelength* (in meters) values to equivalent *frequency* (in cycles) values, or *frequency* values to equivalent *wavelength* values, may be made by referring to the *Meters and f (cycles)* columns in the accompanying *Conversion Table,* which is based on these formulae. This makes *wavelength—frequency* conversion calculations unnecessary, and saves time.

L×C Value for Resonance

The formulae for calculating the *frequency,* or the *wavelength,* to which any resonant circuit containing inductance and capacity will tune are:

$$f = \frac{159{,}000}{\sqrt{L \times C}}$$

$$wavelength = 1885\sqrt{L \times C}$$

where, f = the frequency in *cycles per second*
L = the inductance of the coil in *microhenries*
C = the capacity of the entire circuit in *microfarads.*

The product of the inductance L and the capacity C of the circuit determines the frequency at which the circuit is resonant or in "tune". For each frequency there is a definite value of this product (called the inductance-capacity product, the "$L \times C$" value, or the "$L \times C$" constant) for which resonance occurs. If this value is known, it is possible to determine the correct amount of inductance required for use with any value of capacity (or the correct amount of capacity for use with any value of inductance) to produce resonance at that frequency. The $L \times C$ value must be divided by the known capacity (or the known inductance) to determine the required inductance (or capacitance). Thus:

$$\text{Inductance} = \frac{L \times C \text{ value}}{\text{capacity}}$$

$$\text{Capacity} = \frac{L \times C \text{ value}}{\text{inductance}}$$

L×C Values Tabulated in Table for Speed

In the following table, the inductance × capacity values necessary to produce resonance at wavelengths from 1 to 39,000 meters (corresponding to frequencies from 300,000,000 to 7,690 cycles) have been tabulated for quick-reference purposes to assist in making rapid calculations involving tuning circuits. The inductance, (L), is expressed in microhenries; the capacity, (C), is in *microfarads;* and f is the frequency in *cycles per second.*

Examples of Use of this Conversion Table

As examples of the use of this table:

(1) let it be desired to find how much inductance a coil must have if it is to tune to a frequency of 600 kilocycles (500 meters) with a tuning condenser of 0.00035 microfarads maximum capacity. From the table, the $L \times C$ value for this frequency is found to be 0.0704. Dividing this value by the capacity (0.00035) gives the result, *201 microhenries of inductance.*

(2) Let it be desired to find what capacity of tuning condenser is required if it is to tune to a frequency of 1,500 kilocycles (200 meters) with the above coil of 201 microhenries inductance. The $L \times C$ value for this frequency is found from the table to the 0.01126. Dividing this by the inductance (201) gives as a result 0.000055 microfarads for the minimum capacity. *The tuning condenser must therefore have a range of capacity from 0.000055 to 0.00035 microfarads to cover this frequency range with this coil.* Any other coil and condenser combination may be calculated in this same way.

How to Determine Quantities Beyond the Range of this Table

A study of the table shows that, as the frequency *decreases,* the $L \times C$ constant *increases.* For example, if the frequency is only one-tenth as great, the $L \times C$ constant is 10^2 (or 100) times as large. This must be kept in mind if values beyond the ranges of the table are to be determined. For example, if we wish to determine the $L \times C$ constant for 2 kc (2,000 cycles), we may look up the value for 20,000 cycles in the table (it is 63.3). We then move the decimal point two places to the right; 6,330 is the correct $L \times C$ constant. If it is desired to check the results, remember that resonance occurs when the inductive reactance is equal to the capacitive reactance. The frequency at which this occurs is the *resonance* frequency.

Meters	f (cycles)	L×C
1	300,000,000	0.0000003
2	150,000,000	0.0000011
3	100,000,000	0.0000025
4	75,000,000	0.0000045
5	60,000,000	0.0000057
6	50,000,000	0.0000101
7	42,900,000	0.0000138
8	37,500,000	0.0000180
9	33,330,000	0.0000228
10	30,000,000	0.0000282
15	20,000,000	0.0000635
20	15,000,000	0.0001129
25	12,000,000	0.0001755
30	10,000,000	0.0002530
35	8,570,000	0.0003446
40	7,500,000	0.000450
45	6,670,000	0.000570
50	6,000,000	0.000704
55	5,450,000	0.000852
60	5,000,000	0.001014
65	4,620,000	0.001188
70	4,290,000	0.001378
75	4,000,000	0.001583
80	3,750,000	0.001801
85	3,529,000	0.002034
90	3,333,000	0.002280
95	3,158,000	0.002541
100	3,000,000	0.00282
110	2,727,000	0.00341
120	2,500,000	0.00405
130	2,308,000	0.00476
140	2,143,000	0.00552
150	2,000,000	0.00633
160	1,875,000	0.00721
170	1,764,000	0.00813
180	1,667,000	0.00912
190	1,579,000	0.01015
200	1,500,000	0.01126
210	1,429,000	0.01241
220	1,364,000	0.01362
230	1,304,000	0.01489
240	1,250,000	0.01621
250	1,200,000	0.01759
260	1,154,000	0.01903
270	1,111,000	0.0205
280	1,071,000	0.0221
290	1,034,000	0.0237
300	1,000,000	0.0253
310	968,000	0.0270
320	938,000	0.0288
330	909,000	0.0306
340	883,000	0.0325
350	857,000	0.0345
360	834,000	0.0365
370	811,000	0.0385
380	790,000	0.0406
390	769,000	0.0428
400	750,000	0.0450
410	732,000	0.0473
420	715,000	0.0496
430	698,000	0.0520
440	682,000	0.0545
450	667,000	0.0570
460	652,000	0.0596
470	639,000	0.0622
480	625,000	0.0649
490	612,000	0.0676
500	600,000	0.0704
505	594,000	0.0718
510	588,000	0.0732
515	583,000	0.0747
520	577,000	0.0761
525	572,000	0.0776
530	566,000	0.0791
535	561,000	0.0806
540	556,000	0.0821
545	551,000	0.0836
550	546,000	0.0852
555	541,000	0.0867
560	536,000	0.0883
565	531,000	0.0899
570	527,000	0.0915
575	522,000	0.0931
580	517,000	0.0947
585	513,000	0.0963
590	509,000	0.0980
595	504,000	0.0996
600	500,000	0,1013
605	496,000	0.1030
610	492,000	0.1047
615	488,000	0.1065
620	484,000	0.1082
625	480,000	0.1100
630	476,000	0.1117
635	472,000	0.1135
640	469,000	0.1153
645	465,000	0.1171
650	462,000	0.1189
655	458,000	0.1208
660	455,000	0.1226
665	451,000	0.1245
670	448,000	0.1264
675	444,000	0.1283
680	441,000	0.1302
685	438,000	0.1321
690	435,000	0.1340
695	432,000	0.1360
700	429,000	0.1379
705	426,000	0.1399
710	423,000	0.1419
715	420,000	0.1439
720	417,000	0.1459
725	414,000	0.1479
730	411,000	0.1500
735	408,000	0.1521
740	405,000	0.1541
745	403,000	0.1562
750	400,000	0.1583
755	397,000	0.1604
760	395,000	0.1626
765	392,000	0.1647
770	390,000	0.1669
775	387,000	0.1690
780	385,000	0.1712
785	382,000	0.1734
790	380,000	0.1756
795	377,000	0.1779
800	375,000	0.1801
805	373,000	0.1824
810	370,000	0.1847
815	368,000	0.1870
820	366,000	0.1893
825	364,000	0.1916
830	361,000	0.1939
835	359,000	0.1962
840	357,000	0.1986
845	355,000	0.201
850	353,000	0.203
855	351,000	0.206
860	349,000	0.208
865	347,000	0.211
870	345,000	0.213
875	343,000	0.216
880	341,000	0.218
885	339,000	0.220
890	337,000	0.223
895	335,000	0.225
900	333,000	0.228
905	331,000	0.231
910	330,000	0.233
915	328,000	0.236
920	326,000	0.238
925	324,000	0.241
930	323,000	0.243
935	321,000	0.246
940	319,000	0.249
945	317,000	0.251
950	316,000	0.254
955	314,000	0.257
960	313,000	0.259
965	311,000	0.262
970	309,000	0.265
975	308,000	0.268
980	306,000	0.270
985	305,000	0.273
990	303,000	0.276
995	302,000	0.279
1000	300,000	0.282
1010	297,100	0.287
1020	294,200	0.293
1030	291,300	0.299
1040	288,500	0.304
1050	285,700	0.310
1060	283,000	0.316
1070	280,400	0.322
1080	277,800	0.328
1090	275,200	0.334
1100	272,700	0.341
1110	270,300	0.347
1120	267,900	0.353
1130	265,500	0.359
1140	263,200	0.366
1150	260,900	0.372
1160	258,600	0.379
1170	256,400	0.385
1180	254,200	0.392
1190	252,100	0.399
1200	250,000	0.405
1210	247,900	0.412
1220	245,900	0.419
1230	243,000	0.426
1240	241,900	0.433
1250	240,000	0.440
1260	238,100	0.447
1270	236,200	0.454
1280	234,400	0.461
1290	232,600	0.468
1300	230,800	0.476
1310	229,000	0.483
1320	227,300	0.490
1330	225,600	0.498
1340	223,900	0.505
1350	222,200	0.513
1360	220,600	0.521
1370	219,000	0.528
1380	217,400	0.536
1390	215,800	0.544
1400	214,300	0.552
1410	212,800	0.560
1420	211,300	0.568
1430	209,800	0.576
1440	208,300	0.584
1450	206,900	0.592
1460	205,500	0.600
1470	204,100	0.608
1480	202,700	0.616
1490	201,300	0.625
1500	200,000	0.633
1510	198,700	0.642
1520	197,400	0.650
1530	196,100	0.659
1540	194,800	0.667
1550	193,500	0.676
1560	192,300	0.685
1570	191,100	0.694
1580	189,900	0.703
1590	188,700	0.712
1600	187,500	0.721
1610	186,300	0.730
1620	185,100	0.739
1630	184,000	0.748
1640	182,900	0.757
1650	181,800	0.766
1660	180,700	0.776
1670	199,600	0.785
1680	178,500	0.794
1690	177,400	0.804
1700	176,400	0.813
1710	175,400	0.823
1720	174,400	0.833
1730	173,400	0.842
1740	172,400	0.852
1750	171,400	0.862
1760	170,500	0.872
1770	169,500	0.882
1780	168,500	0.892
1790	167,600	0.902
1800	166,700	0.912
1810	165,700	0.922
1820	164,800	0.932
1830	163,900	0.943
1840	163,000	0.953
1850	162,200	0.963
1860	161,300	0.974
1870	160,400	0.984
1880	159,600	0.995
1890	158,700	1.005
1900	157,900	1.015
1910	157,100	1.026
1920	156,200	1.037
1930	155,400	1.048
1940	154,600	1.059
1950	153,800	1.070
1960	153,100	1.081
1970	152,300	1.092
1980	151,500	1.103
1990	150,800	1.114
2000	150,000	1.126
2020	148,500	1.148
2040	147,100	1.171
2060	145,600	1.194
2080	144,200	1.218
2100	142,900	1.241
2120	141,500	1.265
2140	140,200	1.289
2160	138,900	1.313
2180	137,300	1.338
2200	136,400	1.362
2220	135,000	1.387
2240	133,900	1.412
2260	132,700	1.438
2280	131,600	1.463
2300	130,400	1.489
2320	129,300	1.515
2340	128,200	1.541
2360	127,100	1.568
2380	126,000	1.594
2400	125,000	1.621
2420	124,000	1.548
2440	122,900	1.676
2460	121,900	1.703
2480	121,000	1.731
2500	120,000	1.759
2520	119,000	1.787
2540	118,100	1.816
2560	117,200	1.845
2580	116,300	1.874
2600	115,400	1.903
2620	114,500	1.932
2640	113,600	1.962
2660	112,800	1.991
2680	111,900	2.02
2700	111,100	2.05
2720	110,300	2.08
2740	109,500	2.11
2760	108,700	2.14
2780	107,900	2.18
2800	107,100	2.21
2820	106,400	2.24
2840	105,600	2.27
2860	104,900	2.30
2880	104,200	2.33
2900	103,400	2.37
2920	102,700	2.40
2940	102,000	2.43
2960	101,300	2.47
2980	100,700	2.50
3000	100,000	2.53
3020	99,400	2.57
3040	98,700	2.60
3060	98,100	2.64
3080	97,400	2.67
3100	96,800	2.70
3120	96,200	2.74
3140	95,600	2.78
3160	95,000	2.81
3180	94,400	2.85
3200	93,800	2.88
3220	93,200	2.92
3240	92,600	2.96
3260	92,000	2.99
3280	91,500	3.03
3300	90,900	3.06
3320	90,400	3.10
3340	89,800	3.14
3360	89,300	3.18
3380	88,800	3.22
3400	88,300	3.25
3420	87,700	3.29
3440	87,200	3.33
3460	86,700	3.37
3480	86,200	3.41
3500	85,700	3.45
3520	85,300	3.49
3540	84,800	3.53
3560	84,300	3.57
3580	83,800	3.61
3600	83,400	3.65
3620	82,900	3.69
3640	82,400	3.73
3660	82,000	3.77
3680	81,500	3.81
3700	81,100	3.85
3720	80,700	3.90
3740	80,200	3.94
3760	79,800	3.98
3780	79,400	4.02
3800	79,000	4.06
3820	78,600	4.11
3840	78,200	4.15
3860	77,700	4.19
3880	77,300	4.24
3900	76,900	4.28
3920	76,500	4.32
3940	76,200	4.37
3960	75,800	4.41
3980	75,400	4.46

Units Employed in the Table

In this table the frequency f is expressed in *cycles* per second. Also, $L \times C$ means the product of the inductance in *microhenries* and the capacity in *microfarads* required to produce resonance at the corresponding frequency or wavelength.

(Cont'd)

(Cont'd from preceding page)

Meters	*f* (*cycles*)	L×C
4000	75,000	4.50
4020	74,700	4.55
4040	74,300	4.59
4060	73,900	4.64
4080	73,600	4.69
4100	73,200	4.73
4120	72,800	4.78
4140	72,500	4.82
4160	72,100	4.87
4180	71,800	4.92
4200	71,500	4.96
4220	71,100	5.01
4240	70,800	5.06
4260	70,400	5.11
4280	70,100	5.16
4300	69,800	5.20
4320	69,500	5.25
4340	69,100	5.30
4360	68,800	5.35
4380	68,500	5.40
4400	68,200	5.45
4420	67,900	5.50
4440	67,600	5.55
4460	67,300	5.60
4480	67,000	5.65
4500	66,700	5.70
4520	66,400	5.75
4540	66,100	5.80
4560	65,800	5.85
4580	65,500	5.90
4600	65,200	5.96
4620	65,000	6.01
4640	64,700	6.06
4660	64,400	6.11
4680	64,100	6.17
4700	63,900	6.22
4720	63,600	6.27
4740	63,300	6.32
4760	63,000	6.38
4780	62,800	6.43
4800	62,500	6.49
4820	62,300	6.54
4840	62,000	6.59
4860	61,800	6.65
4880	61,500	6.70
4900	61,200	6.76
4920	61,000	6.81
4940	60,800	6.87
4960	60,500	6.92
4980	60,300	6.98
5000	60,000	7.04
5050	59,400	7.18
5100	58,800	7.32
5150	58,300	7.47
5200	57,700	7.61
5250	57,200	7.76
5300	76,600	7.91
5350	56,100	8.06
5400	55,600	8.21
5450	55,100	8.36
5500	54,600	8.52
5550	54,100	8.67
5600	53,600	8.83
5650	53,100	8.99
5700	52,700	9.15
5750	52,200	9.31
5800	51,700	9.47
5850	51,300	9.63
5900	50,900	9.80
5950	50,400	9.96
6000	50,000	10.13
6050	49,600	10.30
6100	49,200	10.47
6150	48,800	10.65
6200	48,400	10.82
6250	48,400	11.00
6300	47,600	11.17
6350	47,200	11.35
6400	46,900	11.53
6450	46,500	11.71
6500	46,200	11.89
6550	45,800	12.08
6600	45,500	12.26
6650	45,100	12.45
6700	44,800	12.64
6750	44,000	12.83
6800	44,100	13.02
6850	43,800	13.21
6900	43,500	13.40
6950	43,200	13.60
7000	42,900	13.79
7050	42,600	13.99
7100	42,300	14.19
7150	42,000	14.39
7200	41,700	14.59
7250	41,400	14.79
7300	41,100	15.00
7350	40,800	15.21
7400	40,500	15.41
7450	40,300	15.62
7500	40,000	15.83
7550	39,700	16.04
7600	39,500	16.26
7650	39,200	16.47
7700	39,000	16.69
7750	38,700	16.90
7800	38,500	17.12
7850	38,200	17.34
7900	38,000	17.56
7950	37,700	17.79
8000	37,500	18.01
8050	37,300	18.24
8100	37,000	18.47
8150	36,800	18.70
8200	36,600	18.93
8250	36,400	19.16
8300	36,100	19.39
8350	35,900	19.62
8400	35,700	19.86
8450	35,500	20.1
8500	35,300	20.3
8550	35,100	20.6
8600	34,900	20.8
8650	34,700	21.1
8700	34,500	21.3
8750	34,300	21.6
8800	34,100	21.8
8850	33,900	22.0
8900	33,700	22.3
8950	33,500	22.5
9000	33,300	22.8
9050	33,100	23.1
9100	33,000	23.3
9150	32,800	23.6
9200	32,600	23.8
9250	32,400	24.1
9300	32,300	24.3
9350	32,100	24.6
9400	31,900	24.9
9450	31,700	25.1
9500	31,600	25.4
9550	31,400	25.7
9600	31,300	25.9
9650	31,100	26.2
9700	30,900	26.5
9750	30,800	26.8
9800	30,600	27.0
9850	30,500	27.3
9900	30,300	27.6
9950	30,200	27.9
10000	30,000	28.2
10100	29,700	28.7
10200	29,400	29.3
10300	29,100	29.9
10400	28,800	30.4
10500	28,600	31.0
10600	28,300	31.6
10700	28,000	32.2
10800	27,800	32.8
10900	27,500	33.4
11000	27,300	34.1
11100	27,000	34.7
11200	26,800	35.3
11300	26,500	35.9
11400	26,300	36.6
11500	26,100	37.2
11600	25,900	37.9
11700	25,600	38.5
11800	25,400	39.2
11900	25,200	39.9
12000	25,000	40.5
12100	24,800	41.2
12200	24,600	41.9
12300	24,400	42.6
12400	24,200	43.3
12500	24,000	44.0
12600	23,800	44.7
12700	23,600	45.4
12800	23,400	46.1
12900	23,300	46.8
13000	23,100	47.6
13100	22,900	48.3
13200	22,700	49.0
13300	22,600	49.8
13400	22,400	50.5
13500	22,200	51.3
13600	22,100	52.1
13700	21,900	52.8
13800	21,700	53.6
13900	21,600	54.4
14000	21,400	55.2
14100	21,300	56.0
14200	21,100	56.8
14300	21,000	57.6
14400	20,800	58.4
14500	20,700	59.2
14600	20,600	60.0
14700	20,400	60.8
14800	20,300	61.6
14900	20,100	62.5
15000	20,000	63.3
15100	19,870	64.2
15200	19,740	65.0
15300	16,610	65.9
15400	19,480	66.7
15500	19,350	67.6
15600	19,230	68.5
15700	19,110	69.4
15800	18,990	70.3
15900	18,870	71.2
16000	18,750	72.1
16100	18,630	73.0
16200	18,510	73.9
16300	18,400	74.8
16400	18,290	75.7
16500	18,180	76.6
16600	18,070	77.6
16700	17,960	78.5
16800	17,850	79.4
16900	17,740	80.4
17000	17,640	81.3
17100	17,540	82.3
17200	17,440	83.3
17300	17,340	84.2
17400	17,240	85.2
17500	17,140	86.2
17600	17,050	87.2
17700	16,950	88.2
17800	16,850	89.2
17900	16,760	90.2
18000	16,670	91.2
18100	16,570	92.2
18200	16,480	93.2
18300	16,390	94.3
18400	16,300	95.3
18500	16,220	96.3
18600	16,130	97.4
18700	16,040	98.4
18800	15,960	99.5
18900	15,870	100.5
19000	15,790	101.5
19100	15,710	102.6
19200	15,630	103.7
19300	15,540	104.8
19400	15,460	105.9
19500	15,380	107.0
19600	15,310	108.1
19700	15,230	109.2
19800	15,150	110.3
19900	15,080	111.4
20000	15,000	112.6
20200	14,850	114.8
20400	14.710	117.1
20600	14,560	119.4
20800	14,420	121.8
21000	14,290	124.1
21200	14,150	126.5
21400	14,020	128.9
21600	13,890	131.3
21800	13,760	133.8
22000	13,640	136.2
22200	13,510	138.7
22400	13,390	141.2
22600	13,270	143.8
22800	13,160	146.3
23000	13,040	148.9
23200	12,930	151.5
23400	12,820	154.1
23600	12,710	126.8
23800	12,600	159.4
24000	12,500	162.1
24200	12,400	154.8
24400	12,290	167.6
24600	12,190	170.3
24800	12,100	173.1
25000	12,000	175.9
25200	11,900	178.7
25400	11,810	181.6
25600	11,720	184.5
25800	11,630	187.4
26000	11,540	190.3
26200	11,450	193.2
26400	11,360	196.2
26600	11,280	199.1
26800	11,190	202.0
27000	11,110	205.0
27200	11,030	208.0
27400	10,950	211.0
27600	10,870	214.0
27800	10,790	218.0
28000	10,710	221.0
28200	10,640	224.0
28400	10,560	227.0
28600	10,490	230.0
28800	10,420	233.0
29000	10,340	237.0
29200	10,270	240.0
29400	10,200	243.0
29600	10,130	247.0
29800	10,070	250.0
30000	10,000	253.0
31000	9,600	270.0
32000	9,380	288.0
33000	9,090	306.0
34000	8,830	325.0
35000	8,570	345.0
36000	8,340	365.0
37000	8,110	385.0
38000	7,900	406.0
39000	7,690	428.0

— END —

TWIST DRILL SIZES—AND DRILLING DATA

DURING the construction of (and replacement of parts in) radio and electrical equipment it is necessary to drill and tap holes in various kinds of metals and insulating materials for the machine screws, self-tapping screws and eyelets used for fastening the parts together. Radio service men should be familiar with the various sizes of drills and taps commonly used in this work.

Drills

The twist drill is a tool designed to bore a hole in practically any material. The twist drill may have a straight shank which is intended to be held by a 3-jaw chuck, a square shank like a wood bit which is intended to fit into the 2-jaw chuck of a brace, or it may have a taper shank designed to fit in drill presses and lathes.

Three Systems of Drill Size Classification

Three systems of size classification and marking are used for twist drills. These are the *Number, Letter,* and *Fractional* designation systems. In the *Number* series the drills are numbered from 1 to 80; *No. 1* is 0.2280 inch in diameter and No. 80 is 0.0135 inch in diameter (*see accompanying table*). This system is the most commonly used one for the smaller drills. In it the *larger* the drill number, the smaller is the drill diameter.

DIAMETERS OF "NUMBERED" DRILLS

Drill No.	Diam. In.	Drill No.	Diam. In.	Drill No.	Diam. In.
1	.2280	28	.1405	55	.0520
2	.2210	29	.1360	56	.0465
3	.2130	30	.1285	57	.0430
4	.2090	31	.1200	58	.0420
5	.2055	32	.1160	59	.0410
6	.2040	33	.1130	60	.0400
7	.2010	34	.1110	61	.0390
8	.1990	35	.1100	62	.0380
9	.1960	36	.1065	63	.0370
10	.1935	37	.1040	64	.0360
11	.1910	38	.1015	65	.0350
12	.1890	39	.0995	66	.0330
13	.1850	40	.0980	67	.0320
14	.1820	41	.0960	68	.0310
15	.1800	42	.0935	69	.0292
16	.1770	43	.0890	70	.0280
17	.1730	44	.0860	71	.0260
18	.1695	45	.0820	72	.0250
19	.1660	46	.0810	73	.0240
20	.1610	47	.0785	74	.0225
21	.1590	48	.0760	75	.0210
22	.1570	49	.0730	76	.0200
23	.1540	50	.0700	77	.0180
24	.1520	51	.0670	78	.0160
25	.1495	52	.0635	79	.0145
26	.1470	53	.0595	80	.0135
27	.1440	54	.0550		

In the *Letter* series the drills are lettered from *A* to *Z;* these vary in sizes from 0.234 to 0.413 inch in diameter (*see accompanying table*).

DIAMETERS OF "LETTERED" DRILLS

No. Drill	Diam. In.	No. Drill	Diam. In.	No. Drill	Diam In.
A	.234	J	.277	S	.348
B	.238	K	.281	T	.358
C	.242	L	.290	U	.368
D	.246	M	.295	V	.377
E	.250	N	.302	W	.386
F	.257	O	.316	X	.397
G	.261	P	.323	Y	.404
H	.266	Q	.332	Z	.413
I	.272	R	339		

In the *Fractional* series each drill bears a fraction designation equal to the diameter of the drill. The series begins with the smallest size of $\frac{1}{64}$-inch and increases in fractional steps of $\frac{1}{64}$-inch up to 1 inch diameter (*see accompanying table*).

DIAMETERS OF "FRACTIONAL" DRILLS

Drill Size	*Dia.*	*Drill Size*	*Dia.*
1/64	.0156	33/64	.5156
1/32	.0312	17/32	.5312
3/64	.0468	35/64	.5468
$\frac{1}{16}$	.0625	$\frac{9}{16}$	.5625
5/64	.0781	37/64	.5781
3/32	.0937	19/32	.5937
7/64	.1093	39/64	.6093
$\frac{1}{8}$	.1250	$\frac{5}{8}$	.6250
9/64	.1406	41/64	.6406
5/32	.1562	21/32	.6562
11/64	.1718	43/64	.6718
$\frac{3}{16}$	.1875	$\frac{11}{16}$	.6875
13/64	.2031	45/64	.7031
7/32	.2187	23/32	.7187
15/64	.2343	47/64	.7343
$\frac{1}{4}$	.2500	$\frac{3}{4}$	.7500
17/64	.2656	49/64	.7656
9/32	.2812	25/32	.7812
19/64	.2968	51/64	.7968
$\frac{5}{16}$	.3125	$\frac{13}{16}$	.8125
21/64	.3281	53/64	.8281
11/32	.3437	27/32	.8437
23/64	.3593	55/64	.8593
$\frac{3}{8}$	.3750	$\frac{7}{8}$	.8750
25/64	.3906	57/64	.8906
13/32	.4062	29/32	.9062
27/64	.4218	59/64	.9218
$\frac{7}{16}$	.4375	$\frac{15}{16}$	.9375
29/64	.4531	61/64	.9531
15/32	.4687	31/32	.9687
31/64	.4843	63/64	.9843
$\frac{1}{2}$	.5000	1	1.0000

No drill of any one series is the same size as any drill in any other series. The *Numbered* and *Lettered* drill series provide drills of diameters intermediate between those of the $\frac{1}{64}$-inch series.

Drill Markings

The size is usually stamped on the shank of all but the very small drills. Where the marking is not readable (as on the small drills) the size may be determined by fitting the drill into the holes of a drill gauge, or by measuring the diameter with a micrometer and then referring it to a table of drill sizes such as is presented here. These tables are also useful for determining the diameter (in decimals of an inch) of any size drill—whether it be marked with a number, a letter, or a fraction.

High Speed and Low Speed Drills

Drills are made of different grades of steel for different purposes. The twist drill for ordinary work is made of *carbon* steel; for high speed work, and for production, *high speed* steel is used. Due to the great friction in working Bakelite with power drills, a high-speed steel twist drill should always be used on that material.

Lubricants for Drills

A twist drill may be safely used at a higher cutting speed, and the life of its cutting edges prolonged, if a lubricant is used when certain materials are worked. The following table gives the proper lubricant to use for various materials being "turned," "drilled," "reamed" and "tapped" or "milled."

LUBRICANTS FOR CUTTING TOOLS

Material	Turning	Drilling	Reaming	Tapping, Milling
Tool Steel	Dry, or Oil	Oil	Lard Oil	Oil
Soft Steel	Dry, or Soda Water	Oil, or Soda Water	Lard Oil	Oil
Wrought Iron	Dry, or Soda Water	Oil, or Soda Water	Lard Oil	Oil
Cast Iron	Dry	Dry	Dry	Dry
Brass	Dry	Dry	Dry	Dry
Copper	Dry	Dry	"Mixture"	Dry
Babbitt	Dry	Dry	Dry	Dry
Glass	Turpentine, or Kerosene			

"Mixture" is one-third Crude Petroleum, two-thirds Lard Oil. Oil is Sperm or Lard, Sperm preferable. When two lubricants are mentioned, the first is preferable.

The primary purpose of the lubricant is to keep the drill's cutting surface cool and thus to retain the temper. For ordinary purposes, any light machine oil, kerosene or turpentine will do as a lubricant, if those specified in the accompanying table are not available.

Speed and Feed of Drills

Two important considerations in using a drill are the *speed* and the *feed*. The *speed* is of course the rate at which the drill turns, and the *feed* is the rate at which the drill progresses into the stock. Speed and feed are of prime importance in any cutting process. A general rule is *"the harder the material, the slower the speed and the lighter the feed."* The underlying principle is that heat generated by the friction *must not* be allowed to raise the temperature of the cutting edge of the drill to a point at which its temper will be destroyed. For example, even in such soft material as bakelite, high speed will soon ruin a carbon steel drill.

The smaller the drill the faster may be the speed. Examples of proper speeds are:

in hard steel	350 rpm
in cast iron	532 rpm
in brass	912 rpm

The feed is different for each material and each size of drill; it is a matter in which experience is worth more than any rule.

Shape of Drill Point

Insulating materials such as Bakelite, Formica, Celoron, hard rubber, fibre, etc., should be drilled with the point of the drill ground to the usual sixty degree angle but with the front edge of the cutting edge ground straight or flat to remove the hook. Speeds up to 1,500 r-p-m may be used, and the drill may be left dry or else lubricated with lard oil or light machine oil. Insulating materials of this kind are rather hard on a drill and dull the point quickly. When the drill comes through the hole in the back, it is advisable to hold a block of scrap wood solidly against the back surface to prevent the material from chipping or breaking through around the edges.

MACHINE SCREW TAP, TAP-DRILL, & CLEARANCE DRILL SIZES

Taps

Taps are used for cutting threads on the *inside* of round holes. *Dies* are for threading the *outside* of round rods. The first part of each tap or die number indicates the gauge number of the rod stock from which the screws were cut, or the gauge number of the rod to be threaded, respectively; the second part of each number indicates the number of threads per inch, which should correspond to the number of threads per inch on the screw or nut to be used. Thus, a 6 x 32 tap indicates that the screw which screws into the tapped hole is cut from No. 6 rod stock and has 32 threads per inch.

Machine Screw Tap-Drill & Clearance-Drill Sizes

Machine screws of various sizes are used in radio work, the most common being the 6 x 32 (number 6 screw with 32 threads per inch) and the 8 x 32. The tap and clearance drill table presented here shows the screw numbers, the number of threads per inch, and the drills to be used in making holes either for threading (*tapping*) or for allowing the screw to slide through the hole freely (*clearance*). Thus, to produce a tapped hole for a 6 x 32 screw, first drill the hole with a No. 36 drill, and then tap it with a 6 x 32 tap. To drill a clearance hole through which a 6 x 32 screw will slide freely, use the No. 28 clearance size drill.

MACHINE SCREW; TAP, TAP-DRILL & CLEARANCE DRILL SIZES

Size of Screw (No.)	*Threads per Inch*	*Diameter of Screw (inches)*	*For Tapped Hole‡*			*Flor Clearance Hole*	
			Tap Size	*Size of Tapping Drill‡*	*Drill Diameter (inches)‡*	*Size of Clearance or Body Drill*	*Drill Diameter (inches)*
2	48	.086	2x48	No. 49	.073	No. 43	.089
2	56	.086	2x56	49	.073	43	.089
2	64	.086	2x64	50	.070	44	.086
3	40	.099	3x40	47	.0785	39	.0995
3	48	.099	3x48	45	.082	39	.0995
3	56	.099	3x56	45	.082	39	.0995
4	32	.112	4x32	45	.082	31	.120
4	36	.112	4x36	44	.086	31	.120
4	40	.112	4x40	43	.089	31	.120
4	48	.112	4x48	42	.093	31	.120
5	40	.125	5x40	38	.1015	30	.1285
5	44	.125	5x44	37	.104	30	.1285
6	32	.138	6x32	36	.1065	28	.1405
6	36	.138	6x36	34	.111	28	.1405
6	40	.138	6x40	33	.113	28	.1405
8	24	.164	8x24	30	.1285	17	.173
8	32	.164	8x32	29	.136	18	.1695
8	36	.164	8x36	29	.136	19	.166
10	24	.190	8x24	25	.1495	10	.1935
10	32	.190	10x32	21	.159	10	.1935
12	20	.216	12x20	19	.166	2	.221
12	24	.216	12x24	16	.177	2	.221
12	28	.216	12x28	14	.182	2	.221
14	20	.242	14x20	10	.1935	¼	.250
14	24	.242	14x24	7	.201	¼	.250
¼	20	.250	¼x20	7	.201	17/64	.2656
¼	28	.250	¼x28	3	.213	17/64	.2656
5/16	18	.3125	5/16x18	F* 17/64	.257 .2656	21/64	.3281
5/16	24	.3125	5/16x24	I* 9/32	.272 .2812	21/64	.3281
3/8	16	.375	3/8x16	5/16	.3125	25/64	.3906
3/8	24	.375	3/8x24	Q* 21/64	.332 .3281	25/64	.3906
7/16	14	.4375	7/16x14	U* 3/8	.368 .375	29/64	.4531
7/16	20	.4375	7/16x20	25/64	.3906	29/64	.4531
½	13	.500	½x13	27/64	.4218	33/64	.5156
½	20	.500	½x20	29/64	.4531	33/64	.5156

**Preferred size drill if available.*

†*Sizes widely used in radio work.*

‡*These are the drill sizes for average use. The proper size drill to use really depends somewhat on the material being drilled. For tapping Bakelite, hard rubber, or steel, use a drill about one size larger (lower drill number) than specified in this table.*

DECIMAL AND MILLIMETER EQUIVALENTS OF 8ths, 16ths, 32nds, and 64ths OF AN INCH

Fraction				Decimal Equivalent	Millimeter Equivalent
1/64				.0156	0.397
	1/32			.0313	0.794
3/64				.0469	1.191
		1/16		.0625	1.588
5/64				.0781	1.985
	3/32			.0938	2.381
7/64				.1094	2.778
			1/8	.1250	3.175
9/64				.1406	3.572
	5/32			.1563	3.969
11/64				.1719	4.366
		3/16		.1875	4.762
13/64				.2031	5.159
	7/32			.2188	5.556
15/64				.2344	5.953
			1/4	.2500	6.350
17/64				.2656	6.747
	9/32			.2813	7.144
19/64				.2969	7.541
		5/16		.3125	7.937
21/64				.3281	8.334
	11/32			.3438	8.731
23/64				.3594	9.128
			3/8	.3750	9.525
25/64				.3906	9.922
	13/32			.4063	10.319
27/64				.4219	10.716
		7/16		.4375	11.113
29/64				.4531	11.509
	15/32			.4688	11.906
31/64				.4844	12.303
			1/2	.5000	12.700
33/64				.5156	13.097
	17/32			.5313	13.494
35/64				.5469	13.891
		9/16		.5625	14.287
37/64				.5781	14.684
	19/32			.5938	15.081
39/64				.6094	15.478
			5/8	.6250	15.875
41/64				.6406	16.272
	21/32			.6563	16.669
43/64				.6719	17.067
		11/16		.6875	17.463
45/64				.7031	17.860
	23/32			.7188	18.238
47/64				.7344	18.635
			3/4	.7500	19.049
49/64				.7656	19.446
	25/32			.7813	19.842
51/64				.7969	20.239
		13/16		.8125	20.636
53/64				.8281	21.033
	27/32			.8438	21.430
55/64				.8594	21.827
			7/8	.8750	22.224
57/64				.8906	22.621
	29/32			.9063	23.018
59/64				.9219	23.415
		15/16		.9375	23.812
61/64				.9531	24.209
	31/32			.9688	24.606
63/64				.9844	25.004
			1.0	1.0000	25.400

CONVERSION FACTORS FOR ELECTRICAL, PHYSICAL & MATHEMATICAL UNITS

(alphabetically arranged)

ELECTRICAL, MAGNETIC, ELECTROSTATIC

Multiply	*By*	*To obtain*
Amperes per square inch	0.1550	amp. per sq. cm.
Ampere-turns	1.257	gilberts
Ampere-turns per centim.	2.540	amp.-turns per inch
Ampere-turns per centim.	1.257	gilberts per cm.
Ampere-turns per inch	0.3937	amp.-turns per cm.
Ampere-turns per inch	0.4950	gilberts per cm.
Average current (*sine wave*)	1.572	maximum current
Average voltage (*sine wave*)	1.572	maximum voltage
Coulombs per sq. inch	0.1550	coulombs per sq. cm.
Effect. current (*sine wave*)	1.414	maximum current
Effect. voltage (*sine wave*)	1.414	maximum voltage
Farads	10^6	mfd.
Gausses (lines per sq. cm.)	6.452	lines per sq. in.
Gilberts	0.7958	ampere-turns
Gilberts per centimeter	2.021	amp.-turns per inch
Gilberts per centimeter	0.7958	amp.-turns per cm.
Henrys	1000.	maxwells
Kilolines	10^{-5}	webers
Lines	1.	maxwells
Lines per sq. centimeter	1.	gausses
Lines per sq. inch	0.1550	gausses
Max.-current (*sine wave*)	0.636	average current
Max. voltage (*sine wave*)	0.636	average voltage
Max. current (*sine wave*)	0.707	effective current
Max. voltage (*sine wave*)	0.707	effective voltage
Maxwells	10^{-3}	kilolines
Maxwells	1.	lines
Maxwells	10^{-8}	webers
Megalines	10^6	maxwells
Megohms	10^6	ohms
Microfarads	10^{-6}	farads
Microhms	10^{-12}	megohms
Microhms	10^{-6}	ohms
Millihenrys	10^{-3}	henrys
Ohms	10^{-6}	megohms
Ohms	10^6	microhms
Ohms per circ. mil-foot	1.662×10^{-3}	ohms per sq. millmeter-meter
Ohms per 1000 feet	3.2808	ohms per kilometer
Ohms per kilometer	0.3048	ohms per 1000 feet
Ohms per mil-foot	0.1662	microhms per cm. cube
Ohms per mil-foot	0.06524	microhms per inch cube
Ohms per pound	2.2046×10^{-3}	ohms per gram
Ohms per sq. millim.-meter	601.5	ohms per circ. mil-ft.
Ohms per 1000 yards	1.0936	ohms per kilometer
Volts	1000.	millivolts
Webers	10^8	maxwells
Webers	10^5	kilolines

POWER

Multiply	*By*	*To obtain*
Foot-pounds per minute	3.03×10^{-5}	horsepower
Foot-pounds per minute	0.0226	watts
Foot-pounds per second	1.818×10^{-3}	horsepower
Foot-pounds per second	1.356	watts
Horsepower	33,000.	foot-pounds per min.
Horsepower	550.	foot-pounds per sec.
Horsepower	746.	watts
Kilogram-meters per sec.	9.807	watts
Kilowatts	56.88	B.T.U. per minute
Kilowatts	4.427×10^4	foot-pounds per min.
Kilowatts	737.8	foot-pounds per sec.
Kilowatts	1.341	horsepower
Kilowatts	10^3	watts
Watts	0.05688	B.T.U. per minute
Watts	10^7	ergs per sec.
Watts	44.25	foot-pounds per min.
Watts	0.7375	foot-pounds per sec.
Watts	1.341×10^{-3}	horsepower
Watts	0.1020	kilog.-meters per sec.
Watts	10^{-3}	kilowatts

ENERGY

Multiply	*By*	*To obtain*
B.T.U.	0.293	watt-hours
B.T.U.	778.	foot-pounds
B.T.U.	1.055.	joules (*int'l.*)
Foot-pounds	1.285×10^{-3}	B.T.U.
Foot-pounds	1.356	joules (*int'l*)
Foot-pounds	0.1383	kilogram-meters
Gram calories	4.186	joules (*int'l*)
Joules (*international*)	9.48×10^{-4}	B.T.U.
Joules (*international*)	10^7	ergs
Joules (*international*)	0.7378	foot-pounds
Joules (*international*)	0.2389	gram-calories
Joules (*international*)	0.10198	kilogram-meters
Kilogram-meters	7.233	foot-pounds
Kilogram-meters	9.8117	joules (*int'l*)
Kilowatt-hours	3413.	B.T.U.
Kilowatt-hours	2.656×10^6	foot-pounds
Kilowatt-hours	3.6×10^6	joules (*int'l*)
Watt-hours	3.4126	B.T.U.
Watt-hours	2656.	foot-pounds
Watt-hours	0.860	kilogram-calories
Watt-hours	367.2	kilogram-meters
Watt-hours	10^{-3}	kilowatt-hours

FORCE

Multiply	By	To obtain
Dynes	1.020×10^{-3}	grams weight
Dynes	2.248×10^{-6}	pounds weight
Dynes per sq. cm.	10^{-6}	bars
Grams weight	980.7	dynes
Grams weight	10^{-3}	kilograms
Grams weight	0.03527	ounces
Grams weight	2.205×10^{-3}	pounds
Kilograms	980,665.	dynes
Kilograms	10^{3}	grams
Kilograms	2.205	pounds
Pounds	444.823	dynes
Pounds	453.6	grams
Pounds	16.	ounces
Pounds	32.17	poundals

LIGHT & ILLUMINATION

Multiply	By	To obtain
Candles per sq. cm.	6.4516	candles per sq. in.
Candles per sq. cm.	3.1416	lamberts
Candles per sq. in.	0.1550	candles per sq. cm.
Candles per sq. in.	0.4869	lamberts
Foot-candles	1.	lumens per sq. ft.
Foot-candles	10.76	lux
Foot-candles	1.076×10^{-3}	phot
Lamberts	0.3183	candles per sq. cm.
Lamberts	2.0538	candles per sq. in.
Lumens per sq. ft.	1.	foot-candles
Lux	0.0929	foot-candles
Lux	10^{-4}	phot
Phot	929.	foot-candles
Phot	10^{4}	lux

LENGTH

Multiply	By	To obtain
Angstrom units	10^{-8}	centimeters
Angstrom units	3.937×10^{-9}	inches
Angstrom units	10^{-10}	meters
Angstrom units	10^{-4}	microns
Angstrom units	0.1	millimicrons
Centimeters	10^{8}	Angstrom units
Centimeters	0.03281	feet
Centimeters	0.3937	inches
Centimeters	0.01	meters
Centimeters	10.	millimeters
Centimeters	393.7	mils
Centimeters	0.01094	yards
Feet	30.48	centimeters
Feet	0.3048	meters
Inches	$254.\times10^{6}$	Angstrom units
Inches	2.54	centimeters
Inches	0.0254	meters
Inches	25.4	millimeters
Inches	1,000.	mils
Kilometers	0.6214	miles
Meters	10^{10}	Angstrom units
Meters	100.	centimeters
Meters	3.2808	feet
Meters	39.3701	inches
Meters	10^{-3}	kilometers
Meters	10^{6}	microns
Meters	6.214×10^{-4}	miles
Meters	10^{3}	millimeters
Meters	1.0936	yards

(Cont'd)

LENGTH—(Cont'd)

Multiply	By	To obtain
Microns	10,000.	Angstrom units
Microns	0.0001	centimeters
Microns	10^{-6}	meters
Microns	10^{3}	millimicrons
Miles	5280	feet
Miles	1.6093	kilometers
Millimeters	0.03937	inches
Millimeters	39.3701	mils
Microns	10^{4}	Angstrom units
Microns	10^{-6}	meters
Millimicrons	10	Angstrom units
Millimicrons	10^{-3}	microns
Mils	0.001	inches
Mils	0.0254	millimeters
Yards	91.44	centimeters
Yards	0.9144	meters
Yards	5.682×10^{-4}	miles

AREA

Multiply	By	To obtain
Circular mils	5.067×10^{-6}	square cm.
Circular mils	7.854×10^{-7}	square inches
Circular mils	0.7854	square mils
Circular mils	5.066×10^{-4}	sq. millimeters
Square centimeters	0.155	sq. inches
Square feet	0.0929	square meters
Square inches	1.2732×10^{6}	circular mils
Square inches	6.4516	sq. centimeters
Square inches	645.16	sq. millimeters
Square inches	10^{6}	square mils
Square millimeters	0.00155	square inches
Square millimeters	1,973.51	circular mils
Square meters	10.764	square feet
Square mils	1.2732	circular mils
Square mils	0.000001	square inches

MISCELLANEOUS

Multiply	By	To obtain
Bar (*international*)	10^{6}	dynes per sq. cm.
Centigrade degrees +273	1.	absolute temp. (°C)
Centigrade deg. +17.77	1.8	Fahrenheit degrees
Cubic feet	1,728.	cubic inches
Cubic inches	16.383	cubic centimeters
Dynes per sq. cm.	10^{-6}	bars (*international*)
Fahrenheit degrees +460	1.	absolute temp. (°F)
Fahrenheit degrees —32	0.555	centigrade degrees
Feet per pound	6.7197×10^{-4}	meters per gram
Gallons	231.	cubic inches
Grams	15.432	grains
Kilograms	2.205	pounds
Kilograms per sq. mm.	1,422.34	pounds per sq. in.
Liters	61.022	cubic inches
Liters	0.2642	gallons
Pounds	0.4536	kilograms
Pounds per ohm	453.59	grams per ohm
Pounds per square inch	7.031×10^{-4}	kg. per sq. mm.
Radians	57.30	degrees
Radians	3438.	minutes
Radians per sec.	57.30	degrees per sec.
Radians per sec.	9.549	revolutions per min.
Radians per sec.	0.1592	revolutions per sec.
Revolutions	360.	degrees
Revolutions	6.283	radians

METRIC PREFIXES USED IN RADIO WORK—AND CONVERSION FACTORS FOR THEM

IT so happens that many of the units which have been used exclusively in electrical work for many years are either too small or too large for convenient expression or use in radio work. Examples of these are the *farad*, the *henry*, etc.

Metric Prefixes and their Abbreviations

Instead of using large, cumbersome numbers to indicate the fractional or multiple parts of these units, it has become customary to employ standard metric prefixes ahead of the standard units to simplify expressions and calculations involving these quantities. These metric prefixes are so commonly used in radio work that the service man should familiarize himself with them, so that he may become proficient in understanding and using them. A list of these prefixes is given below:

Prefix	*Abbreviation*	*Meaning*
deci	*d*	one-tenth part of
centi	*c*	one-hundredth part of
mil or ***milli***	*m*	one-thousandth part of
micro	μ	one-millionth part of
pica or ***micro-micro***	μμ	one-millionth of a millionth part of
deka	*dk*	10 times
hekto	*h*	100 times
kilo	*k*	1,000 times
mega	*M*	1,000,000 times

Thus, the prefix ***deci*** ahead of a standard unit means that the new unit is 0.1 of the standard unit. Therefore, a ***deci***meter is 0.1 of a meter. Likewise, the prefix ***milli*** means that the new unit is 0.001 of the standard unit. Thus, a ***milli***ampere (ma.) is 0.001 of an ampere (*amp.*). Similarly, a ***micró***henry (μ*h*) is 0.001,001 of a henry (*h*), a ***micro***farad (μ*fd.*) is 0.000,001 of a farad, etc. Instead of saying that a condenser has a capacitance of 0.00035 microfarads (μ*fd.*) for example, it is more simple and convenient to say that it has a capacitance of 350 ***micro***-microfarads (μμ*fd.*), etc.

A *centimeter* of inductance is equal to 0.001 of a *microhenry*. (This unit does not follow the general rule.)

The prefix ***deka*** means that the new unit is 10 times the standard unit. The prefix ***kilo*** means that the new unit is 1,000 times the standard unit. Thus, one ***kilo***cycle equals 1,000 cycles. The prefix ***meg*** or ***mega*** means that the new unit is 1,000,000 times the original unit. Thus, a ***meg***ohm equals 1,000,000 ohms, etc.

Conversion of Units Expressed with Metric Prefixes

As it often is very difficult for persons inexperienced in the handling of mathematical computations to correctly convert from one form to another the various electrical units which are expressed with the common metric prefixes, the following factors for conversion have been arranged in tabular form here (alphabetically) to assist in this work.

TABLE OF CONVERSION FACTORS
(*alphabetically arranged*)

Multiply	*By*	*To obtain*
Amperes	× 1,000,000,000,000	micro-microamperes
Amperes	× 1,000,000	microamperes
Amperes	× 1,000	milliamperes
Cycles	× .000,001	megacycles
Cycles	× .001	kilocycles
Farads	× 1,000,000,000,000	micro-microfarads or picofarads
Farads	× 1,000,000	microfarads
Farads	× 1,000	millifarads
Henries	× 1,000,000	microhenries
Henries	× 1,000	millihenries
Kilocycles	× 1,000	cycles
Kilovolts	× 1,000	volts
Kilowatts	× 1,000	watts
Megacycles	× 1,000,000	cycles
Megohms	× 1,000,000	ohms
Mhos	× 1,000,000	micromhos
Mhos	× 1,000	millimhos
Microamperes	× .000001	amperes
Microfarads	× 1,000,000	micro-microfarads
Microfarads	× .000001	farads
Microhenries	× .000001	henries
Micromhos	× .000001	mhos
Microhms	× .000001	ohms
Microvolts	× .000001	volts
Microwatts	× .000001	watts
Micro-microfarads	× .000,000,000,001	farads
Micro-microfarads	× .000.001	microfarads
Micro-microhms	× .000,000,000,001	ohms
Milliamperes	× .001	amperes
Millihenries	× .001	henries
Millimhos	× .001	mhos
Milliohms	× .001	ohms
Millivolts	× .001	volts
Milliwatts	× .001	watts
Ohms	× .000001	megohms
Ohms	× 1,000,000,000,000	micro-microhms
Ohms	× 1,000,000	microhms
Ohms	× 1,000	milliohms
Volts	× 1,000,000	microvolts
Volts	× 1,000	millivolts
Watts	× 1,000,000	microwatts
Watts	× 1,000	milliwatts
Watts	× .001	kilowatts

HOW TO USE EXPONENTS IN RADIO CALCULATIONS

SINCE speed and accuracy are essential in technical work, it has become common practice to express very *large* quantities (especially those having many zeros), and also very small numbers (decimals), by means of simpler *whole* numbers and the multiple 10 carrying an index (exponent) to indicate the power to which it is raised. The 10 is called the *base*. The small integer at the right of and above the base is called the *exponent*. Its value tells how many times the base 10 is to be used as a factor, and its sign (whether + or —) indicates whether the factor is to be a *multiplicand* or a *divisor*.

For example, the rather cumbersome number 350,000,000 may be written simply as 3.5×10^8, which really means that 3.5 is multiplied by *ten*, eight times. In this case, the *exponent* is *8*. Likewise, the number 8,400,000 may be written simply as 8.4×10^6. In this case, the *exponent* is *6*.

"Sign" of the Exponent

The exponent is *positive* for numbers greater than 1, and *negative* for numbers less than 1. The sign of the exponent indicates whether the designated power of 10 is to be used as a *multiplier* or as a *divisor*. When the exponent is *negative*, it is preceded by a minus sign and is understood to indicate *division;* when no minus sign precedes the exponent it is automatically understood to be *positive* and to indicate *multiplication*. For example, 12×10^{-3} means $12 \div (10 \times 10 \times 10) = 0.012$; but 12×10^3 means $12 \times (10 \times 10 \times 10) = 12{,}000$.

Thus the cumbersome expression 0.0005 may be written simply as 5×10^{-4}. The number 0.000035 may be written simply as 35×10^{-6}, etc.

Values of "Factors" Corresponding to Various Values of Exponents

This representation is really a shorthand method of working with inconveniently large or small quantities, and service men should become thoroughly familiar with it, as it is used extensively in technical work. The table below will be found helpful in understanding the meaning of the various exponents commonly used, and the value of the factor in each.

$10^1 =$ 10 = Ten
$10^2 =$ 100 = One Hundred
$10^3 =$ 1,000 = One Thousand (*Kilo.*)
$10^6 =$ 1,000,000 = One Million (*Mega.*)

$10^{-1} =$ .1 = One Tenth
$10^{-2} =$ .01 = One Hundredth
$10^{-3} =$ .001 = One Thousandth (*Milli.*)
$10^{-6} =$ .000001 = One Millionth (*Micro.*)

Summary of Rules Regarding Exponents

The rules dealing with exponents are simple, and, when mastered, provide an exceptionally easy method for expressing and working with otherwise cumbersome numbers. They are as follows:

(1) When multiplying numbers, *add* the exponents.
(2) When dividing numbers, *subtract* the exponents.
(3) When squaring numbers, *double* the exponents.
(4) When obtaining square roots, *halve* the exponents.
(5) When transfering an exponent across the dividing line, *change its sign.*

Example: Express the following quantities in simple number by the use of exponents. (*a*) 342,000,000,000 (*b*) 9,653,000 (*c*) 0.0000084 (*d*) 0.000432.

Answers: (*a*) 3.42×10^{11} (*b*) 9.653×10^6 (*c*) 8.4×10^{-6} (*d*) 4.32×10^{-4}. *Ans.*

Example: 6.28×10^{18} electrons flowing past a given point in a second constitute a current of 1 ampere. How many electrons flow past a given point in a second and when the number of amperes is (*a*) 600? (*b*) 0.002?

Solutions: (*a*) $6.28 \times 10^{18} \times 6 \times 10^2 = 37.68 \times 10^{20}$, or 3.768×10^{21}. ***Ans.***

(*b*) $6.28 \times 10^{18} \times 2 \times 10^{-3} = 12.56 \times 10^{15}$, or 1.256×10^{16}. *Ans.*

SUMMARY OF IMPORTANT ELECTRICAL, RADIO & VACUUM TUBE FORMULAE

OHM'S LAW FORMULAE FOR DIRECT CURRENT CIRCUITS

Ohm's Law can be expressed in several different forms, all of which are conveniently tabulated below.

Note that in working out any problem, all terms must be reduced to *volts*, *amperes* and *watts* when used in any of the formulae. For example, 30 milliamperes must be written as 0.030 amperes, 2.5 K.W. must be written as 2500 watts, 1 megohm as 1,000,000 ohms, etc.

I (amperes) =			$\frac{E}{R}$	$\sqrt{\frac{W}{R}}$	$\frac{W}{E}$	
R (ohms) =	$\frac{E}{I}$				$\frac{E^2}{W}$	$\frac{W}{I^2}$
E (volts) =		IR		$\sqrt{WR}$		$\frac{W}{I}$
W (watts) =	EI	I^2R	$\frac{E^2}{R}$			
G (mhos) =	$\frac{I}{E}$				$\frac{W}{E^2}$	$\frac{}{W}$

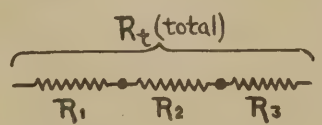
RESISTANCE RELATIONS

RESISTANCE OF ANY MATERIAL—ANY SIZE—AT ANY TEMPERATURE

$$R_2 = R_c \times P\ [1 + \alpha\ (t_2 - 20°C)]$$

Where: R_2 is the resistance of the material at Centigrade temperature t_2
R_c is the resistance of a piece of copper of the same cross-section area and length (see *"Ohms per 1000 Feet"* column in Copper Wire Data Table in Sec. 52 of this Handbook)
P is the *"relative resistance"* of the material (see *"Relative Resistance"* column in data table in Sec. 44 of this Handbook)
α is the temperature coefficient of resistance of the material (see same table in Sec. 44)
t_2 is the Centigrade temperature of the material (at which the resistance R_2 is to be calculated)

RESISTANCES IN SERIES:



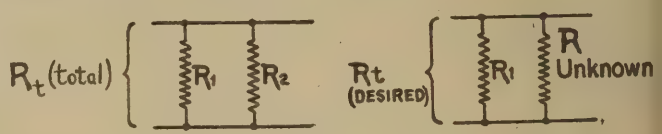
$$R_t = R_1 + R_2 + R_3 + \text{etc.}$$

Where: R_t is the total resistance
R_1, R_2, R_3, etc., are the individual resistances
All resistances must be expressed in the *same* unit (*ohms, megohms,* etc.)

(Cont'd)

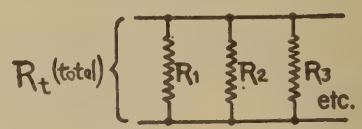
RESISTANCE RELATIONS—(Cont'd)

RESISTANCES IN PARALLEL (two only):



$$R_t = \frac{R_1 \times R_2}{R_1 + R_2} \qquad R_{(\text{unknown})} = \frac{R_t \times R_1}{R_1 - R_t}$$

RESISTANCES IN PARALLEL (many):



$$\frac{1}{R_t} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \text{etc.}$$

$$\text{or, } R_t = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \text{etc.}}$$

(all resistances in above formulae must be expressed in *same* unit (*ohms, megohms,* etc.)

SHUNT MULTIPLIER RESISTOR FOR A CURRENT METER:

Where: R_s = Shunt resistor
R_m = Resistance of meter
I_t = Total current
I_m = Meter current

$$R_s = \frac{R_m}{\frac{I_t}{I_m} - 1}, \quad I_m = \frac{R_m + R_s}{R_s I_t}$$

$$I_t = I_m \frac{R_m + R_s}{R_s}, \quad R_m = R_s \frac{I_t - I_m}{I_m}$$

SERIES MULTIPLIER RESISTOR FOR A VOLTMETER:

Where: E = New voltage range
E_m = Original voltage range of meter
R_s = Series resistor
R_m = Resistance of meter

$$R_s = R_m \left(\frac{E}{E_m} - 1 \right)$$

(Cont'd)

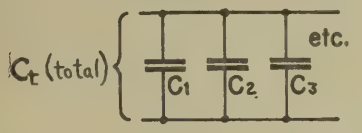
CAPACITANCE RELATIONS

CAPACITANCE OF A PARALLEL-PLATE CONDENSER:

$$C = \frac{2235\ (N-1)\ AK}{10^{10} \times t}$$

Where: C is the capacitance in mfd.
N is the number of plates
A is the area of one side of one plate (in square inches)
K is the dieletric constant
t is the spacing between the plates (in inches)

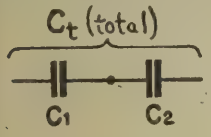
CAPACITANCE OF CONDENSERS IN PARALLEL:

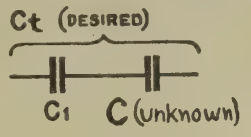


$$C_t = C_1 + C_2 + C_3 + etc.$$

Where: C_t is the total capacitance
C_1, C_2, C_3, etc. are the individual capacitances
All capacitances must be expressed in the same unit (*farads, mfd., mmfd.*, etc.)

CAPACITANCE OF CONDENSERS IN SERIES (two only):

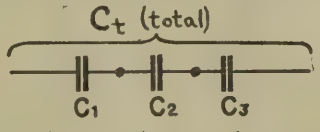




$$C_t = \frac{C_1 \times C_2}{C_1 + C_2} \qquad C_{(unknown)} \frac{C_1 \times C_t}{C_1 - C_t}$$

All capacitances must be expressed in the same unit (*farads, mfd., mmfd.*, etc.)

CAPACITANCE OF CONDENSERS IN SERIES (many):



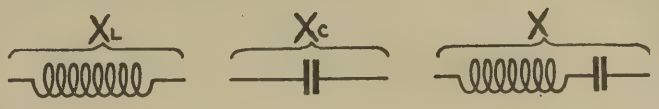
$$\frac{1}{C_t} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + etc.$$

$$\text{or, } C_t = \frac{1}{\frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + etc.}$$

All capacitances must be expressed in the same unit (*farads, mfd., mmfd.*, etc.)

RELATIONS FOR ALTERNATING CURRENT CIRCUITS

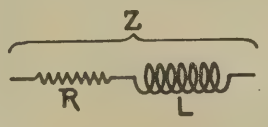
SIMPLE REACTANCE:

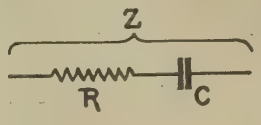


$$X_L = 2\pi fL \qquad X_c = \frac{1}{2\pi fC} \qquad X = 2\pi fL - \frac{1}{2\pi fC}$$

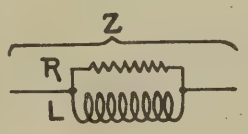
Where: X_L is the inductive reactance in *ohms*
X_C is the capacitive reactance in *ohms*
X is the *net* reactance in *ohms*
2π is a "constant" equal to *6.28*
f is the frequency in *cycles per second*
L is the inductance in *henries*
C is the capacitance in *farads*

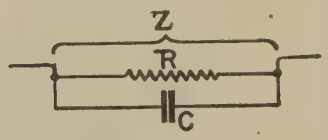
COMPLEX IMPEDENCE:





$$Z = \sqrt{R^2 + (2\pi Lf)^2} \qquad Z = \sqrt{R^2 + \frac{1}{(2\pi Cf)^2}}$$





$$Z = \frac{2\pi LRf}{\sqrt{R^2 + (2\pi Lf)^2}} \qquad Z = \frac{R}{\sqrt{4\pi^2 R^2 C^2 f^2 + 1}}$$

Where: Z is the impedance of the circuit in *ohms* all other quantities have the same meaning as explained above for *"SIMPLE REACTANCE"*.

IMPEDANCE OF RESISTANCE, CAPACITANCE & INDUCTANCE IN SERIES:

$$Z = \sqrt{R^2 + \left(2\pi fL - \frac{1}{2\pi fc}\right)^2}$$

IMPEDANCE OF RESISTANCE, CAPACITANCE & INDUCTANCE IN PARALLEL:

$$Z = \frac{RX_L\ X_C}{\sqrt{(RX_L - RX_C)^2 + X_L^2\ X_C^2}}$$

(Cont'd over)

RELATIONS FOR ALTERNATING CURRENT CIRCUITS—(Cont'd)

OHM'S LAW FOR A-C CIRCUITS:

$$I = \frac{E}{Z}, \quad E = I \times Z, \quad Z = \frac{E}{I}$$

Where: I = current in *amperes*
E = e.m.f in *volts*
Z = the impedance in *ohms*

SINE-WAVE VOLTAGE RELATIONS:

For a size-wave voltage:

(1) *Maximum* voltage = 1.414 × Effective voltage

(2) *Effective* voltage = 0.707 × Maximum voltage

(3) *Average* voltage = 0.636 × Maximum voltage

(Same relations apply between average, effective and maximum *current*—for a sine wave)

POWER IN AN A-C CIRCUIT:

$$W = E \times I \times \frac{R}{Z}, \text{ or } E \times I \times \textit{Cosine } \theta$$

Where: W = power in *watts*

and $\frac{R}{Z}$ is called the *Power Factor*

$$= \frac{\textit{true power}}{\textit{apparent power}} = \frac{I \times R}{E}$$

POWER FACTOR OF A CONDENSER:

$$Pf = \frac{R}{\sqrt{R^2 + \left(\frac{1}{\omega C}\right)^2}}$$

Where: R = the resistance of the condenser
ω = 6.28 times the frequency
C = capacity in farads

FACTOR OF MERIT OF A COIL OR CONDENSER:

$$\textit{For a coil, } Q = \frac{\omega L}{R} = \frac{2\pi f L}{R}$$

$$\textit{For a condenser, } Q = \frac{1}{\omega RC} = \frac{1}{2\pi f RC}$$

Where: Q is the *factor of merit* (sometimes called the *dissipation constant*)

(Cont'd)

RELATIONS FOR ALTERNATING CURRENT CIRCUITS—(Cont'd)

RESONANCE FORMULAE:

$$f = \frac{1}{2\pi\sqrt{LC}}, \textit{ or } L = \frac{1}{(2\pi f)^2 C}, \textit{ or } C = \frac{1}{(2\pi f)^2 L}$$

Where: f = resonance frequency in *cycles*, L = inductance in *henrys*, and C = capacitance in *farads*.

When f, L and C are expressed in the units indicated below, the formulae become:

$$f_{(kc)} = \frac{159.2}{\sqrt{L\ (microhenries) \times C\ (mfd.)}}$$

or,

$$f_{(kc)} = \frac{159{,}200}{\sqrt{L\ (microhenries) \times C\ (mmfd.)}}$$

$$L_{(microhenries)} = \frac{(159.2)^2}{f^2_{(kc)}\ C_{(mfd.)}}$$

$$C_{(mfd.)} = \frac{(159.2)^2}{f^2_{(kc)}\ L_{(microhenries)}}$$

RESONANT WAVELENTH:

Wavelength (in *meters*) at which resonance occurs with given values of inductance (L) and capacitance (C).

$$\textit{Wavelength} = 1885\sqrt{L\ (microhenries) \times C\ (mfd.)}$$

or,

$$\textit{Wavelength} = 1.885\sqrt{L\ (microhenries) \times C\ (mmfd.)}$$

FREQUENCY AND WAVELENGTH RELATIONS:
(for RADIO — not for sound)

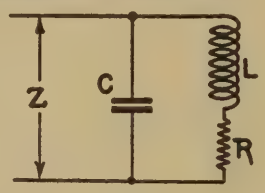
$$\textit{Wavelength (meters)} = \frac{300{,}000{,}000}{\textit{Frequency (cycles)}}$$

$$\textit{Wavelength (meters)} = \frac{300{,}000}{\textit{Frequency (kc)}}$$

$$\textit{Frequency (cycles)} = \frac{300{,}000{,}000}{\textit{Wavelength (meters)}}$$

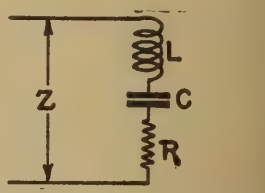
$$\textit{Frequency (kc)} = \frac{300{,}000}{\textit{Wavelength (meters)}}$$

IMPEDANCE RELATIONS IN SERIES AND PARALLEL RESONANT CIRCUITS:



$$Z = \frac{2\pi f L}{4\pi^2 f^2 LC - 1}$$

At Resonance:
$Z = Q\,2\pi f L$



$$Z = \sqrt{\left(2\pi f L - \frac{1}{2\pi f C}\right)^2 + R^2}$$

At Resonance:
$Z = R$

(Where Q is the "factor of merit" of the coil $= \frac{2\pi f L}{R}$

(Cont'd)

INDUCTANCE OF SINGLE-LAYER AIR-CORE COIL (unshielded)

$$L = 0.0251\, d^2\, n^2\, l\, K$$

Where: L is the inductance in *microhenries*
d is the mean diameter of the coil in *inches*
n is the number of *turns per inch*
l is the length of the *coil* (when wound) in *inches*
K is a "form factor" (Nagoaka's correction factor), which depends for its value upon the ratio of the diameter to the length of the coil. Values of K for a wide range of coil diameter-to-length ratios are presented in the table below.

An alternate form of this formula used frequently is:

$$L = \frac{0.0251\, d^2\, n^2\, K}{l}$$

Where: n = total number of turns on coil
d, k and l have the same significance as for the alternate formula given above.

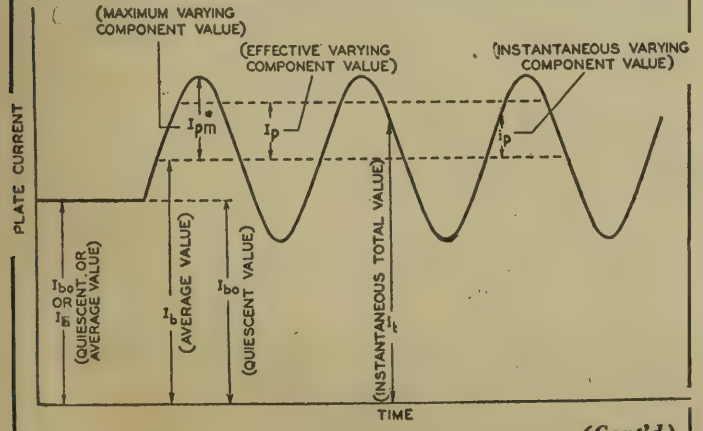
VALUES OF "K" FOR USE IN THE INDUCTANCE FORMULA*

d/l	K	d/l	K	d/l	K	d/l	K	d/l	K
0.00	1.0000	1.20	.6475	2.80	.4452	5.40	.3050	16.00	.1457
.10	.9588	1.30	.6290	3.00	.4292	5.80	.2916	18.00	.1336
.20	.9201	1.40	.6115	3.20	.4145	6.20	.2795	20.00	.1236
.30	.8838	1.50	.5950	3.40	.4008	6.60	.2685	24.00	.1078
.40	.8499	1.60	.5795	3.60	.3882	7.00	.2584	28.00	.0959
.50	.8181	1.70	.5649	3.80	.3764	7.40	.2491	35.00	.0808
.60	.7885	1.80	.5511	4.00	.3654	7.80	.2406	45.00	.0664
.70	.7609	1.90	.5379	4.20	.3551	8.50	.2272	60.00	.0528
.80	.7351	2.00	.5255	4.40	.3455	9.50	.2106	80.00	.0419
.90	.7110	2.20	.5025	4.60	.3364	10.00	.2033	00.00	.0350
1.00	.6884	2.40	.4816	4.80	.3279	12.00	.1790	——	——
1.10	.6673	2.60	.4626	5.00	.3198	14.00	.1605	——	——

*NOTE: This formula assumes the coil to be wound with an infinitely thin conducting tape, the edges of which touch, though electrically insulated. The correction for the commercially available conductors commonly used for winding inductance coils employed in radio equipment (silk, cotton, or enamel-covered wires) is relatively small and may be neglected so far as practical results are concerned.

VACUUM TUBE LETTER SYMBOLS
(IRE Standards)

Symbols which follow are for *instantaneous total, average or quiescent, instantaneous varying component*, and



(Cont'd)

VACUUM TUBE LETTER SYMBOLS—(Cont'd)
(IRE Standards)

effective or maximum varying component values of grid and plate currents and voltages. When varying voltages alone are applied to the grid and plate, the *instantaneous* and *average* or *quiescent* values are identical. In these cases it is suggested that the symbols for the average or quiescent values be used, reserving the instantaneous symbols for use when the voltages are varying.

When current, voltage, and power vary with time, lower-case italice should be used for instantaneous values, and capital italics for average or quiescent values. The capital letters may be used to designate either maximum, effective, average, or quiescent values. When necessary to distinguish btween the maximum and effective values, the subscript m may be added to indicate maximum values, as E_{pm}. When necessary to distinguish between average and quiescent values, the subscript o may be added to indicate quiescent values, as E_{bo}.

Symbol	*Meaning*
e_c	Instantaneous total grid voltage
e_b	Instantaneous total plate voltage
i_c	Instantaneous total grid current
i_b	Instantaneous total plate current
E_c	Average or quiescent value of grid voltage (*grid-bias voltage*)
E_b	Average or quiescent value of plate voltage (*B-supply voltage*)
I_c	Average or quiescent value of grid current
I_b	Average or quiescent value of plate current (*no-signal plate current*)
e_g	Instantaneous value of varying component of grid voltage
e_p	Instantaneous value of varying component of plate voltage
i_g	Instantaneous value of varying component of grid current
i_p	Instantaneous value of varying component of plate current
E_g, or E_s	Effective or maximum value of varying component of grid voltage (*signal voltage*)
E_p	Effective or maximum value of varying component of plate voltage
I_g	Effective or maximum value of varying component of grid current
I_p	Effective or maximum value of varying component of plate current
E_f	Filament or heater terminal voltage
I_f	Filament or heater current
I_s	Total electron emission
g_j	Conductance of electrode j
r_j	Resistance of electrode j
g_p	Plate conductance
r_p	Internal alternating-current plate resistance
R_L	Load resistance
g_g	Grid conductance
r_g	Grid resistance
g_{jk}	Transconductance from electrode k to electrode j

(Cont'd over)

VACUUM TUBE LETTER SYMBOLS—(Cont'd)

g_m	($\equiv g_{gp}$) Grid-plate transconductance (mutual conductance)
g_n	($\equiv g_{pg}$) Plate-grid transconductance (inverse mutual conductance)
μ_{jkl}	μ factor, electrodes j and k with respect to the current of electrode l
Mu, or μ	Amplification factor
C_{gp}	Grid-plate capacitance
C_{gk}	Grid-cathode capacitance
C_{pk}	Plate-cathode capacitance
C_{gh}	Grid-heater capacitance
C_{ph}	Plate-heater capacitance
C_g	Grid capacitance
C_p	Plate capacitance
C_k	Cathode capacitance
E_{inv}	Peak (or crest) inverse voltage
E_{fwd}	Peak (or crest) forward voltage
e^1_{fwd}	Instantaneous tube voltage drop
t_h	Tube heating time
t_d	Deionization time
t_k	Cathode heating time
P_o	Power output
P_i	Power input
P_p	Anode dissipation

VACUUM TUBE CONSTANTS

Amplification factor (*Mu* or μ =

$$\frac{\text{Change in plate voltage } (E_p)}{\text{Change in control-grid voltage } (E_c)}$$

(under the conditions that the plate current remains unchanged and that all other electrode voltages are maintained constant)

A.C. plate resistance in ohms (r_p) =

$$\frac{\text{Change in plate voltage } (E_p)}{\text{Change in plate current in amp. } (I_p)}$$

(under the condition that the grid voltage is held constant)

Mutual conductance in mhos (g_m) =

$$\frac{\text{Change in plate current in amp. } (I_p)}{\text{Change in control-grid voltage } (E_c)}$$

(under the condition that the plate voltage is held constant)

Also, $g_m = \dfrac{\mu}{r_p}$

VACUUM TUBE AMPLIFIER FORMULAE

Current flow through plate load $= I_p = \dfrac{\mu E_s}{r_p + R_L}$

Voltage output (*across plate load*) =

$$E_{R_L} = I_p R_L = \frac{\mu \times E_s \times R_L}{r_p + R_L}$$

Voltage amplification (*gain*) per stage $= \dfrac{E_{R_L}}{E_s} = \dfrac{\mu \times R_L}{r_p + R_L}$

(Cont'd)

VACUUM TUBE AMPLIFIER FORMULAE —(Cont'd)

Power output (*delivered to load resistor*) =

$$P_o = I^2 R_L = R_L \left(\frac{\mu \times E_s}{r_p + R_L} \right)^2$$

Power amplification $= \dfrac{\mu^2 \times R_L \times R_E}{(r_p + R_L)^2}$

(where R_E = input resistor in grid circuit)

Maximum power output $= \dfrac{(\mu \times E_s)^2}{4 r_p}$

Maximum *undistorted* power output $= \dfrac{2(\mu \times E_s)^2}{g r_p}$

When E_s is the maximum (*peak*) value of the a.c. signal input:

Maximum undistorted power output $= \dfrac{(\mu \times E_s)^2}{g r_p}$

Plate efficiency (%) =

$$\frac{\textit{power output (in watts)} \times 100}{\textit{average d.c. plate volts} \times \textit{average d.c. plate amps.}}$$

Power sensitivity (*mhos*) =

$$\frac{\textit{power output (in watts)}}{\textit{(R.M.S. input signal voltage)}^2}$$

MISCELLANEOUS FORMULAE

THE DECIBEL:

The number of decibels corresponding to a given *power ratio* is *10* times the common logarithm* of the ratio: Thus:

$$db = 10 \log_{10} \frac{P_2}{P_1}$$

In the case of a *voltage* or *current* ratio the number of decibels corresponds to *20* times the common logarithm of the ratio (if the two voltages, or the two currents, operate into the same or equal impedances). Thus:

$$db = 20 \log_{10} \frac{E_1}{E_2}$$

and, $$db = 20 \log_{10} \frac{I_1}{I_2}$$

*For explanation of logarithms, and a table of common logarithms see Sect. *58* on page *686*.

CLASSIFIED RADIO TRADE DIRECTORIES

SERVICE MEN often have occasion to communicate with manufacturers of radio receivers, parts, accessories, tubes, sound amplifier and recording equipment, test instruments, etc. On such occasions, it is frequently difficult for them to find the exact street addresses to write to. In many cases, the *trade name* of the manufacturer's product is known, but the actual name and address of the manufacturer is not. (This is especially true in the case of many "Private Brand," "Orphan", or very old receivers.) To assist service men in situations of this kind, the Classified Radio Trade Directories presented in the following sections of this book have been compiled, giving both *trade* and *manufacturer* names, addresses, and products for all American manufacturers of Radio, Television and Facsimile Receivers; Private Brand Receiver Distributors; Radio Accessories; Radio Parts; Sound Amplifier Equipment; and Test Equipment. In addition, there are directories of "Correspondence", and "Resident" Radio Schools; Radio Manual, Handbook, and Textbook Publishers; Radio Magazines and Trade Publications. These directories cover a total of 111 different manufacturer classifications—with all manufacturer's names and trade names arranged in alphabetical sequence for quick reference. Most of these directories have been arranged in the compact "quick-find" chart form that service men have indicated their preference for.

It must be kept in mind that some changes will necessarily take place in these data from time to time.* Some organizations whose names appear here will change their addresses, some will go out of business, some will be absorbed by others, some will change their names through affiliations, etc. It will be noticed that some of the names now on the directories are those of manufacturers who had already gone out of business at the time this Handbook went to press. In all such cases, the fact is indicated. Such names have been retained so that anyone using the directories will know definitely that the manufacturer is no longer in business and that it would probably be useless to write to him for technical data or other information. It is felt that it is better to do this than to drop the name from the Directory entirely, since then, the service man would not know whether it was missing from the Directory, or whether the manufacturer was no longer in business.

Blank spaces have been left after the various sections in the directories wherever possible so that the names and addresses of new manufacturers who may come into the field may be written in at the proper places at any time.

***Note: For the "duration" most of the "active" manufacturers listed in these directories will be engaged mainly in the manufacture of equipment for the armed forces. It is expected that they will resume the manufacture of civilian equipment thereafter.**

TRADE DIRECTORIES START ON NEXT PAGE

— A —

ABC RADIO LABS., (*"ABC"*), 3334 New Jersey St., Indianapolis, Ind.
"Abbey", SPLITDORF ELECT. CO., (*no longer manufacturing*)
"AC Dayton", *"Navigator"*, AC DAYTON CO., (*no longer manufacturing*)
"Ace" (Original), ACE RADIO CO., (*no longer manufacturing*)
"Ace" (Later), RADIO CIRCULAR CO., INC., 111 E. 42 St., New York, N. Y.
"Acme", *"Moto-Midget"*, ACME ELECT. & MF'G. CO., (*no longer manufacturing*)
"Acratest" (see FEDERATED PURCHASER, INC.)
***"Acratone"* (see FEDERATED PURCHASER, INC.)**
***"Admiral"* (see CONTINENTAL RADIO & TELEVISION CORP.)**
"Advance", *"Falck"*, ADVANCE ELECT. CO., 1260 W. 22 St., Los Angeles, Cal.
"Aeolian Hall", AEOLIAN CO., THE, 27 West 57 St., New York, N. Y.
"Aero" (see HOODWIN CO., CHARLES)
"Aeronautic" (see MISSION BELL RADIO MFG. CO.)
"Aero Products" (see HOODWIN CO., CHARLES)
"Aerovoice", AEROVOICE, INC., Islip, New York
"Aetna", AETNA RADIO CORP., (Division Walgreen Drug Co.), 6650 S. Cicero, Chicago, Ill.
"Air Castle" (see SPIEGEL, MAY STERN)
"Air Chief" (see FIRESTONE TIRE & RUBBER CO.)
"Airite" (see INTERNATIONAL RADIO CORP.)
"Air King", AIR KING PRODUCTS CO., INC., 1523-63 St., Brooklyn, N. Y.
"Airline", (see MONTGOMERY WARD & CO.)
***"Air Master"* (see AUTOMATIC RADIO MFG. CO., INC.)**
"Air Queen", AIR KING PRODUCTS CO., INC., 1523-63 St., Brooklyn, N. Y.
"Ajax", (see PHILMORE MFG. CO.)
"All American Mohawk", *"Lyric"*, *"Mohawk"*, ALL AMERICAN MOHAWK CORP.—(*no longer manufacturing*)
"Alemite" (see STEWART WARNER CORP.)
ALLIED RADIO CORP. (*"Knight"; "Roamer"*), 833 W. Jackson Blvd., Chicago, Ill.
ALLIED STORES (private brand *"Aria"*), 1440 Broadway, New York, N. Y.
"All Star", WARWICK MFG. CO., 1700 W. Washington Blvd., Chicago, Ill.
ALL WAVE RADIO CORP., 142 Liberty St., New York, N. Y. (*no longer manufacturing radio receivers*)
"Alonson" (see COMMONWEALTH RADIO MFG. CO.)
"American" (see GENERAL TELEV. & RADIO CORP., N. Y. C.)
"American Bosch", AMERICAN BOSCH CORP., 3664 Main St., Springfield, Mass.
AMERICAN FOUNDATION FOR THE BLIND, 15 West 16 St., New York, N. Y.
"American World", PACIFIC RADIO CORP., 844 W. Adams St., Chicago, Ill.
AMRAD (*"Bel Canto"*)—(no longer manufacturing radio sets)

(Cont'd)

(Cont'd)

AMPLEX RADIO CORP., 240 W. 23 St., New York, N. Y. (*no longer manufacturing*)
ANDREA RADIO CORP. (*"Andrea"*), 43-20 34th St., Long Island City, N. Y.
ANSLEY RADIO CORP. (*"Dynaphone"*), 21-10 49th Ave., Long Island City, New York
***"Apex"* (see U. S. RADIO & TELEVISION CO.)**
***"Arcadia"* (see WELLS-GARDNER & CO.)**
"Argus", ARGUS RADIO CORP., (*no longer manufacturing radio sets*)
"Argyle" (see U. S. RADIO & TELEV. CORP.)
"Aria" (see ALLIED STORES)
"Arkay" (see R. K. RADIO LABS., INC.)
"Arlington" (see WARWICK MFG. CO.)
"Arrow" (see ECOPHONE RADIO CORP.)
***"Arvin"* (see NOBLITT-SPARKS INDUSTRIES, INC.)**
***"Atlas"* (see AIR-KING PRODUCTS CO., INC.)**
ATWATER KENT MFG. CO., 4700 Wissahickon Ave., Philadelphia, Pa. (*no longer manufacturing radio receivers*)
AUDIOLA RADIO CO.—(*no longer manufacturing radio receivers*) —see FAIRBANKS-MORSE & CO.
AUTOCRAT RADIO CO. (*"Autocrat"*), 3855 N. Hamilton Ave., Chicago, Ill.
***"Automaster"* (see AUTOMATIC RADIO MFG. CO., INC.)**
AUTOMATIC RADIO MFG. CO., INC. (*"Automatic"; "Air Master"; "Automaster"; "Auto-Rola"; "Tom Thumb"*); 122 Brookline Ave., Boston, Mass.
***"Auto-Rola"* (see AUTOMATIC RADIO MFG. CO.)**
"Auto Tone" (see WARWICK MFG. CO.)
AUTO-VOX RADIO CO.,—(*no longer manufacturing*)
"Autra" (see WARWICK MFG. CO.)
"Aztec" (before 1932) FRED W. STEIN (*no longer manufacturing*)

— B —

"Baldwin" (old) (see PFANSTEIHL PRODUCTS CORP.)
"Balkeit", BALKEIT RADIO CORP., 549 W. Randolph St., Chicago, Ill. (*no longer manufacturing radio sets*)
"Band Box" (see CROSLEY RADIO CORP.)
BARKER BROS. (private brand *"Tempotone"*), Los Angeles, California
***"Bel Canto"* (see AMRAD)**
BELKNAP HARDWARE & MF'G. CO. (*"Belknap"*), 111 E. Main St., Louisville, Ky.
"Bell", BELL RADIO & TELEV. CO., 125 E. 46 St., New York, N. Y. —(*no longer manufacturing*)
"Bell Tone" (see AIR KING PRODUCTS CO.)
BELMONT RADIO CORP., (*"Belmont"*, *"Classique"*, *"Crusader"*, *"Goodyear Wings"*, *"Truetone"*, *"Freshman"*, *"Imperial"*, *"Starck Classique"*, *"Wings"*), 1257 Fullerton Ave., Chicago, Ill.
"Bendix", BENDIX RADIO MFG. CO., Wood Lake, Minn.
"Best", PACIFIC RADIO CORP., 844 W. Adams St., Chicago, Ill.
"Beverly" (see WARWICK MF'G. CO.)

(Cont'd on next page)

*Television & Facsimile Receiver Manufacturers are grouped together on page 719.

†See Note at bottom of page 709.

—(Cont'd from preceding page)

"Blackbird" (see PHILMORE MF'G. CO.)
"Blue bird" (see PHILMORE MF'G. CO.)
BOND PRODUCTS CO., 13139 Hamilton Ave., Detroit, Mich.
"B. O. P." (see UNITED MOTORS SERVICE)
"Bosch" (see AMERICAN BOSCH CORP.)
"Bostonian", CLINTON RADIO MFG. CO., 1217 W. Washington Blvd., Chicago, Ill.
"Brandes", KOLSTER RADIO CORP.—(*no longer manufacturing*)
BRAUN, WALTER C., INC., 601 W. Randolph St., Chicago, Ill. (see listings under RADOLEK CO.)
Bremer Tully, BREMER TULLY MFG. CO.—(*no longer manufacturing*)
"Breting", BRETING RADIO MFG. CO., 1815 Venice Blv'd., Los Angeles, Cal.
BROWN & MANHART CO., (*"Ranger"*), Los Angeles, Calif.
"Browning" (see DEUTSCHMANN, TOBE, CORP.)
BROWNING-DRAKE CORP.,—(*no longer manufacturing*)
"Browning Labs", BROWNING LABORATORIES, 750 Main St., Winchester, Mass.
"Brunswick", (line of radio receivers under this name now being mnf'd. by MERSMAN BROS. CORP., Celina, Ohio—also by BRUNSWICK RADIO & TELEV. DIVISION, 244 Madison Ave., New York, N. Y.)
BRUNSWICK BALKE—(*no longer manufacturing radio sets*)
BRUNSWICK RADIO CO.—(*no longer manufacturing radio sets*)
BRUNSWICK RADIO & TELEVISION DIVISION, 244 Madison Ave., New York, N. Y.
"Buckingham" (original), *"Huntington"*, *"La Salle (1932)"*, *"Remington"*, BUCKINGHAM RADIO CORP., (*no longer manufacturing*)
"Buckingham" (*Plant "A"* on license tag), see CLINTON RADIO MFG. CO.)
"Buckingham" (Serial Number preceded by *"25"*), PACIFIC RADIO CORP.
"Buick" (see UNITED MOTORS SERVICE)
"Bulova", BULOVA WATCH CO., 580 Fifth Ave., New York, N. Y. —(*no longer manufacturing radio sets*)
"Burley", (see SENTINEL RADIO CORP.)
"Bush and Lane," BUSH & LANE PIANO CO.

— C —

"Cable-Nelson" (see HOWARD RADIO CO.)
"Cadillac Motors" (CADILLAC DIVISION, GENERAL MOTORS CORP., Detroit, Mich.)
"Calvert", *"Cavalier"*, *"Mobilette"*, CALVERT MOTORS ASSOCIATES, LTD., 1028 Linden Ave., Baltimore, Md.
"Camden", (see RADIO PRODUCTS CORP.)
"Canadian Westinghouse", CANADIAN WESTINGHOUSE CO., LTD., Hamilton, Canada
"Capehart", *"Panamuse"*, THE CAPEHART CORP., INC., now a division of FARNSWORTH TELEV. & RADIO CORP., Fort Wayne, Ind.
"Caravan", (see WARWICK MFG. CO.)
"Carlton" (see U. S. RADIO & TELEV. CORP.)

—(Cont'd)

—(Cont'd)

"Case" (original), CASE ELECT. CORP., Marion, Indiana—(taken over by U. S. RADIO & TELEV. CORP.)
"Case" (present),—(see MAJESTIC RADIO & TELEV. CO.)
"Cavalcade", CAVALCADE RADIO CO., 29 E. North Water St., Chicago, Ill.
"Cavalcade", CAVALCADE RADIO CORP., 271-7th St., San Francisco, Calif.
"Cavalier" (see CALVERT MOTORS ASSOCIATES LTD.)
"Century", CENTURY RADIO PRODUCTS CO.—(*no longer manufacturing radio sets*)
"Challenger" (see HALLICRAFTERS, INC.)
"Champion" (old), CHAMPION RADIO MF'G. CO.—(*no longer manufacturing*)
"Champion" (present), *"La Salle"*, *"Monarch"*, *"Victory"*, CHAMPION RADIO LABS., 14553 Madison Ave., Lakewood, Ohio
"Chevrolet" (see UNITED MOTORS SERVICE)
"Chrysler-Philco" (see PHILCO RADIO & TELEV. CORP.)
"Clago", *"Mayfair"*, *"Radiochron"*, CLAGO RADIO CORP.—(*no longer manufacturing*)
"Clarion" (early), TRANSFORMER CORP. OF AMERICA, 69 Wooster St., New York, N. Y.—(*no longer manufacturing radio receivers*)
"Clarion" (early), CLARION RADIO CORP., 35 E. Wicker Drive, Chicago, Ill.—(*no longer manufacturing*)
"Clarion" (present, "W. M. Co." on license tag) (see WARWICK MF'G. CO.)
"Classic", (see INSULINE CORP. OF AMERICA)
"Classique" (see BELMONT RADIO CORP.)
"Clearodyne", (see CLEARTONE RADIO CORP.)
CLEARTONE RADIO CORP., (*"Clearodyne"*, *"Goldcrest"*) — (*no longer manufacturing*)
"Climax", *"Cunningham"*, CLIMAX RADIO & TELEV. CO., 511 S. Sangamon St., Chicago, Ill.—(now operated as GENERAL TELEV. & RADIO CORP.)
"Clinton," *"Corona"*, *"Crusader"*, *"Cub"*, *"Bostonian"*, *"Buckingham"*, *"Federal"*, *"Harmony"*, *"Marshall"*, *"Nightengale"*, *"Universal"*, *"Westminster"*, (with "Plant A" on license tag) CLINTON MFG. CO., 1217 W. Wash. Blvd., Chicago, Ill.—(*no longer manufacturing*)
"Clipper" (see RADIO PRODUCTS SALES CO.)
"Colonial", COLONIAL RADIO CORP., 254 Rano St., Buffalo, N. Y. (*no longer manufacturing radio sets under Colonial name—now owned by Sears Roebuck*)
"Columbia" (old), COLUMBIA PHONO CO.,—(*no longer manufacturing radio sets*)
"Columbia" (old), COLUMBIA RADIO CO., (*no longer manufacturing*)
"Columbia" (*model C100*), (see MAJESTIC RADIO & TELEV. CORP.)
"Comet" (old), COLIN B. KENNEDY—(*no longer manufacturing*)
"Comet", (see HAMMARLUND MFG. CO., INC.)
COMMONWEALTH RADIO MFG. CO., (*"Alonsen"*, *"Com-Rad"*, *"Star Raider"*), 4848 Lincoln Ave., Chicago, Ill.—(*no longer manufacturing radio receivers*)

—(Cont'd on next page)

—(Cont'd from preceding page)

"*Com-Rad*" (see COMMONWEALTH RADIO MFG. CO.)
CONSOLIDATED RADIO PROD. CO., 5540 Webb Ave., Detroit, Mich., (see BOND PRODUCTS CO.)
CONSOLIDATED RADIO & TELEV. CO., ("*Hollywood*"), 45 Astor Place, New York, N. Y.—(*no longer manufacturing*)
"*Continental*", (*original*), "*Admiral*", "*Fearnola*", "*Globe Trotter*", "*Marshall*", "*Oriole*", "*Radiomaster*", "*Slagle*", "*Sunbeam*", "*Radiomaster*", "*Wondertone*", CONTINENTAL RADIO & TELEV. CORP., 3800 W. Cortland St., Chicago, Ill.
"*Continental*" (present), RADIO PRODUCTS CORP., 3800 W. Cortland St., Chicago, Ill.
"*Co-op*" (1938), (see RADIO PRODUCTS CORP.)
"*Corona*" (early, usually with "*C*" preceding Serial No.), "*Duette*", "*Symphonic*", CORONA RADIO & TELEV. CORP., 420 N. Sacramento St., Chicago, Ill.—(*no longer manufacturing*)
"*Corona*" (early, with "Plant A" on license tag), see CLINTON MFG. CO.
"*Corona*" (present), CORONA RADIO & TELEV. CORP., 1500 Dayton St., Chicago, Ill. (see also J. P. SEEBURG CORP.)
"*Coronado*" (private brand of GAMBLE STORES, INC.—see GAMBLE-SKOGMO, INC.)
"*Coronado*" (*WG 24*" on license tag), (see MONTGOMERY WARD & CO.)
"*Corsair*" (see CROSLEY RADIO CORP.)
"*Courier*", GRAY ELECT. CO. & UNITED REPRODUCERS CO.—(*no longer manufacturing*)
"*Crosley*", "*Bandbox*", "*Corsair*", "*Gembox*", "*Gemchest*", "*Jewelbox*", "*Roamio*", "*Showbox*", CROSLEY RADIO CORP. (also DE-FOREST CROSLEY), 1329 Arlington St., Cincinnati, Ohio
"*Croyden*" ("*W.M. Co.*" on license tag)—(see WARWICK MFG. CO.)
"*Crusader*" ("*OA*" on license tag)—(see BELMONT RADIO CORP.)
"*Crusader*" ("*Plant A*" on license tag) (see CLINTON MFG. CO.)
"*Crusader*" (see RADIO PRODUCTS CORP.)
"*Cub*" (see CLINTON MFG. CO.)
"*Cunningham*", (see CLIMAX RADIO & TELEV. CO.)

— D —

"*Dayfan*" (early), DAYFAN RADIO CO.—(*no longer manufacturing*)
"*Dayfan*" (later), (DELCO RADIO CORP.,—see GENERAL MOTORS CORP.)
"*Dayrad*" (DAYTON RADIO CORP.—now RADIO PRODUCTS CORP.)
"*Dayton, AC*", AC DAYTON CO.,—(*no longer manufacturing radio sets*)
DAYTON RADIO CORP.—*now RADIO PRODUCTS CORP.*
DE-FOREST CROSLEY (*part of CROSLEY RADIO CORP.*)
"*Delco*", DELCO RADIO DIV., GENERAL MOTORS CORP., Kokomo, Ind.
"*De Soto*" (home models), (see MONTGOMERY, WARD & CO.)
"*De Soto-Philco*" (auto radios)—(see PHILCO RADIO & TELEV. CORP.)
"*De Luxe*" ("*W.M. Co.*" on license tag)—see WARWICK MFG. CO.)

—(Cont'd)

—(Cont'd)

"*Delta De Luxe*" ("*W.M. Co.*" on license tag)—(see WARWICK MFG. CO.)
"*Detrola*", "*Pee Wee*", "*Road Chief*", "*Road Master*", "*Warwick*", DETROLA RADIO & TELEV. CORP., 1501 Beard Ave., Detroit, Mich.
DEUTSCHMANN, TOBE, CORP. ("*Browning*", "*Tobe Tuner*"), Canton, Mass.
"*De Wald*", DE WALD RADIO MFG. CORP., 440 Lafayette St., New York, N. Y.
"*Dictograph*", DICTOGRAPH PROD. CO., INC., 580 Fifth Ave., New York, N. Y.—(*no longer manufacturing radio sets*)
"*Dinah*" (see WARWICK MF'G. CO.)
"*Dodge-Philco*" (see PHILCO RADIO & TELEV. CORP.)
"*Doraphone*" (see SETCHELL CARLSON, INC.)
"*Druid*" (see WARWICK MFG. CO.)
"*Dual Tone*" (see WARWICK MFG. CO.)
"*Duette*" (see CORONA RADIO & TELEV.)—made for WALGREEN DRUG CO.
"*Dunn-Hall*", "*Remington*", "*Tiny Tim*", DUNN-HALL CO., 1477 W. Adams Blvd., Los Angeles, Calif.
"*Dynaphone*" (see ANSLEY RADIO CORP.)

— E —

"*Echophone Commercial*", ECHOPHONE RADIO CO., 201 E. 26 St., Chicago, Ill.
ECKSTEIN RADIO & TELEV. CO., "*L'Tatro*", Le Roy, Minnesota.
"*Ecophone*", "*Arrow*", ECOPHONE RADIO CORP. (*no longer manufacturing*)
"*Edison*", THOMAS A. EDISON, INC.,—(*no longer manufacturing radio sets*)
"*Edison-Bell*", EDISON-BELL CO., INC., (*no longer manufacturing*)
"*Electrophone*", HARRIS MFG. CO.—(*no longer manufacturing radio sets*)
ELECTRICAL RESEARCH LABS., INC., ("*Erla*", "*Sentinel*", "*Ramway*", "*Sky Rover 1929-1930*", "*Tone Master*"), 2020 Ridge Ave., Evanston, Ill.
"*Electromatic*", ELECTROMATIC DISTRIBUTORS, INC., 88 University Place, New York, N. Y.
"*Electrotone*" (see HARRIS MFG. CO.)
ELGIN RADIO & TELEV. CORP., 34 W. 17 St., New York. N. Y.—(*no longer manufacturing radio sets*)
"*Emerson*", "*Emersonette*", EMERSON RADIO & PHONO CORP., 111 Eighth Ave., New York, N. Y.
"*Empire*", EMPIRE ELECT. PRODUCTS—(now owned by FADA RADIO & ELECT. CO.)
"*Endurance*" (see WESTERN TIRE & AUTO STORES, INC.)
"*Ensign*" (see ESPEY MFG. CO., INC.)
"*Erla*" (see ELECTRICAL RESEARCH LABS., INC., and see SENTINEL RADIO CORP.)
"*Espey*", "*Ensign*", "*WQXR Receiver*", "*Yorker*", ESPEY MFG. CO., INC., 305 E. 63 St., New York City
"*Eveready*" (see NATIONAL CARBON CO.)

—(Cont'd on next page)

—(Cont'd from preceding page)

— F —

"*Fada*", "*Motoset*", FADA RADIO AND ELECTRIC CO., (also EMPIRE ELECTRICAL PRODUCTS), 30-20 Thomson Ave., Long Island City, N. Y.
"*Fairbanks-Morse*", FAIRBANKS-MORSE & CO., (also see AUDIOLA RADIO CO.), 2060 Northwestern Ave., Indianapolis, Ind.
FAIR STORE, THE, ("*La France*"), Chicago, Ill.
"*Falck*" (see ADVANCE ELECTRIC CO.)
"*Farnsworth*", "*Capehart*", FARNSWORTH TELEV. & RADIO CORP., Fort Wayne, Indiana
"*Fearnola*" ("*RPC*" on license tag)—see CONTINENTAL RADIO & TELEV. CORP.
"*Fearnola*" ("*WG 24*" on license tag)—see WELLS GARDNER CO.
"*Fearnola*" ("*W.M. Co.*" on license tag)—see WARWICK MFG. CO.
"*Federal*" (old), FEDERAL RADIO CORP.—(*no longer manufacturing radio receivers*)
"*Federal*" ("*Plant A*" on license tag),—see CLINTON MFG. CO.
FEDERAL RECORDER CO., INC., 50 W. 57 St., New York, N. Y.
FEDERATED PURCHASER, INC., ("*Acratest*", "*Acratone*"), 23-25 Park Place, New York, N. Y.
"*Fenway*" (see FERGUSON RADIO CORP.)
"*Ferguson*", FERGUSON RADIO CORP., 745 Broadway, New York, N. Y., (*no longer manufacturing radio receivers*)
"*Fidelitone*" ("*W.M. Co.*" on license tag), see WARWICK MFG. CO.
"*Fidelitone*" ("*WG 24*" on license tag), see WELLS GARDNER CO.
"*Fidel-O-Matic*" (see LEHMAN RADIO SALON, INC.)
"*Fireside*" (see FREELY CORP.)
"*Firestone*", "*Air Chief*", "*Roamer*", FIRESTONE TIRE & RUBBER CO., Akron, Ohio; Memphis, Tenn.; or Los Angeles, Calif.
"*Foraco*", FORACO CORP.—(*no longer manufacturing radio receivers*)
"*Ford-Philco*" (see PHILCO RADIO & TELEV. CORP.)
"*Fordson*", "*Goldentone*", "*Warwick*", FORDSON EXPORT CORP., 2111 Woodward Ave., Detroit, Mich.
"*Franklin*", FRANKLIN RADIO CORP.,—(*no longer manufacturing*)
"*Freed-Eisemann*" (see FREED RADIO CORP.)
FREED RADIO CORP. ("*Freed-Eisemann*"), 200 Hudson St., New York, N. Y.
FREELY CORP. ("*Fireside*"), 2 W. 20 St., New York, N. Y.—(*no longer manufacturing*)
"*Freshman*" (original), CHAS. FRESHMAN CO.,—(*no longer manufacturing*)
"*Freshman*" (*BRC* on license tag), see BELMONT RADIO CORP.

— G —

"*Gamble*" (see KINGSTON RADIO CO., INC.)
"*Gamble-Skogmo*" (see KINGSTON RADIO CO., INC.)
GALVIN MFG. CORP. ("*Goldenvoice*", "*Motorola*", "*Pep Boys*", "*Sporter*", "*Vita-Tone*"), 4545 Augusta Blvd., Chicago, Ill.

—(Cont'd)

—(Cont'd)

"*Garod*", GAROD RADIO CORP., 70 Washington St., Brooklyn, N. Y.
"*Gaylord*", "*Syncratone*", GAYLORD MFG. CO., 605 Washington Blvd., Chicago, Ill. (*no longer manufacturing radio receivers*)
"*Gembox*" (see CROSLEY RADIO CORP.)
"*Gemchest*" (see CROSLEY RADIO CORP.)
"*General*" (see WESTERN AUTO SUPPLY CO., and see GENERAL RADIO & TELEV. CORP. of Chicago)
"*General*" ("*T. R. & T.*" on license tag), see RADOLEK CO.
"*General*" ("*W. M. Co.*" on license tag), see WARWICK MFG. CO.
"*General Electric*", "*Musaphonic*", GENERAL ELECTRIC CO., Bridgeport, Conn.
GENERAL ELECTRIC CO., LTD., (*CANADIAN*), Toronto, Canada
GENERAL HOUSEHOLD UTILITIES CO., ("*Grunow*"), 2680 N. Pulaski Road, Chicago, Ill., —(*no longer manufacturing radio receivers*)
GENERAL MOTORS CORP. ("*Day-Fan*"), Dayton, Ohio (*no longer being manufactured*)
GENERAL MOTORS CORP. (Radio Div.), Kokomo, Indiana
GENERAL TELEV. & RADIO CORP., ("*American*",) 257 W. 17 St., New York, N. Y.—(*no longer manufacturing radio sets—see WESTERN AUTO SUPPLY CO.*)
GENERAL TELEV. & RADIO CORP., ("*General*")—(formerly *CLIMAX RADIO & TELEV.*)—511 S. Sangamon St., Chicago, Ill.
"*Gilfillan*", GILFILLAN BROTHERS, INC., 1815 Venice Blvd., Los Angeles, Calif.
"*Globe Trotter*", GLOBE TROTTER RADIO CO., 349 W. Randolph St., Chicago, Ill.
"*Globe Trotter*" (see CONTINENTAL RADIO & TELEV. CORP.)
"*Gloritone*" (see U. S. RADIO & TELEV. CORP.)
GOLDBLATT STORES, (private brand "*Kennedy*"), Chicago, Ill.
"*Goldcrest*" (see CLEARTONE RADIO CORP.)
"*Goldentone*" (see FORDSON EXPORT CO.)
"*Goldentone*" ("*W. M. Co.*" on license tag)—see WARWICK MFG. CO.
"*Goldenvoice*" (see GALVIN MFG. CORP.)
"*Gold Medal*" (see WARWICK MFG. CO.)
"*Gold Test*" (see WARWICK MFG. CO.)
GOODRICH ("*Mantola*"), see listing under "*Mantola*"
"*Goodyear*", GOODYEAR TIRE & RUBBER CO., 1144 East Market St., Akron, Ohio
"*Goodyear Wings*"—private brand of GOODYEAR SERVICE STORES (see BELMONT RADIO CORP.)
"*Graham-Philco*" (see PHILCO RADIO & TELEV. CORP.)
"*Granada*" (see WELLS GARDNER CO.)
"*Graybar*", GRAYBAR ELECT. CO., 420 Lexington Ave., New York, N. Y.—(*no longer manufacturing radio sets*)
"*Great Northern*" (see WELLS GARDNER CO.)
"*Grebe*", "*Synchrophase*", GREBE MFG. CO., INC., 70 Washington St., Brooklyn, New York.
GRIGSBY-GRUNOW (see MAJESTIC RADIO & TELEV. CO.)
GRIMES, DAVID, INC., ("*Inverse Duplex*"; "*New Yorker*")—(no longer manufacturing radio receivers)

—(Cont'd on next page)

—(Cont'd from preceding page)

"Grunow" (see GENERAL HOUSEHOLD UTILITIES CO.)
"Gulbransen", GULBRANSEN RADIO CO. (see WELLS GARDNER & CO.)—(*no longer manufacturing radio sets*)
"Gypsy" (see KINGSTON RADIO CO., INC.)

— H —

"Hallicrafters", *"Challenger"*, *"Sky Buddy"*, *"Radio Compass"*, *"Sky Challenger"*, *"Sky Champion"* *"Sky Chief"* (*1937*), *"Sky Master"*, *"Sky Traveler"*, *"Ultra Sky Rider 1937"*, *"Skyrider"*,' THE HALLICRAFTERS CO., 2611 S. Indiana Ave., Chicago, Ill.
"Halson", HALSON RADIO & TELEV. CORP., Meriden, Conn.
HALSON RADIO MFG. CORP., (now reorganized as HALSON RADIO & TELEV. CORP.)
"Hamilton", HAMILTON RADIO CORP., 142 W. 26 St., New York, N. Y.—(*no longer manufacturing*)
HAMMARLUND MFG. CO., INC., (*"Comet"*, *"Pro"*, *"Super Pro"*), 424 West 33 St., New York City
HARRIS MFG. CO. (*"Electrotone"*), 2422 W. 7 St., Los Angeles, Calif.
"Hatry", HATRY & YOUNG, 203 Ann St., Hartford, Conn.
"Harmony" (see CLINTON MFG. CO.)
"Herald" (see INTERNATIONAL TRADING CORP.)
"Hetro", HETRO ELECTRICAL INDUSTRIES, INC., 4611-17 Ravenswood Ave., Chicago, Ill.
"Hobbs" (see MISSION BELL RADIO MFG. CO.)
"Hollywood" (see CONSOLIDATED RADIO & TELEV. CO.)—*no longer being manufactured*
HOMOCORD MFG. CO., INC., 457 W. 45 St., New York, N. Y.
"Hoodwin, Charles", *"Aero"*, *"Aero Products"*, CHARLES HOODWIN CO.,—(*no longer manufacturing*)
HORN, HERBERT H. MFG. CO., (*"Tiffany-Tone"*), 1201 S. Olive St., Los Angeles, Calif.
"Howard", *"Cable-Nelson"*, HOWARD RADIO CO., 1731-35 Belmont Ave., Chicago, Ill.
"Hudson" (*"WG 24"* on license tag), made by WELLS GARDNER CO. for HUDSON MOTOR CO.
"Huntington" (see BUCKINGHAM RADIO CORP.)
"Hupmobile-Philco" (see PHILCO RADIO & TELEV. CORP.)

— I —

"ICA" (see INSULINE CORP. OF AMERICA)
"Imperial" (see BELMONT RADIO CORP.)
INSULINE CORP. OF AMERICA, (*"I.C.A."*, *"Classic"*, *"Mascot"*), 30-30 Northern Blvd., Long Island City, N. Y.
INTERNATIONAL RADIO CORP., (*"Airite"*, *"Kadette"*, *"St. Regis"*, now operated as KADETTE RADIO CORP., Ann Arbor, Mich.
INTERNATIONAL TRADING CORP., (*"Herald"*), 176 W. Adams, St., Chicago, Ill.
"Inter-Ocean" (see ZENITH RADIO CORP.)
"Inverse Duplex" (see GRIMES, DAVID, INC.)

—(Cont'd)

—(Cont'd)

— J —

"Jackson Bell", *"Peter Pan"*, JACKSON BELL CO., LTD., Los Angeles, Calif.—(*no longer manufacturing*)
"Jewel", JEWELL MFG. CO.,—(*no longer manufacturing*)
"Jewelbox" (see CROSLEY RADIO CORP.)
JEFFERSON-TRAVIS RADIO MFG. CORP., 198 Milburn Ave., Baldwin, New York, (*Marine Receivers*)

— K —

"Kadette", KADETTE RADIO CORP., Ann Arbor, Mich.
"Karadio", KARADIO CORP., 2233 University Ave., St. Paul, Minn.
KELLER-FULLER MFG. CO. LTD., (*Radiette*), 4957 Sunset Blv'd., Los Angeles, Calif.—(*no longer manufacturing*)
"Kennedy", (old), *"Royal"*, Colin B. Kennedy Co.,—(*no longer manufacturing*)
"Kennedy" (recent), (see GOLDBLATT STORES)
"Keystone", (see RADOLEK CO.)
"King" (original) *"Royal"*, KING MFG. CORP.,—(absorbed by COLONIAL RADIO CORP.)
"King" (recent) (see RADOLEK CO.)
"Kingsbury" (see WARWICK MFG. CO.)
KINGSTON RADIO CO., INC., (*"Coronado"*, *"Gamble"*, *"Gamble-Skogmo"*, *"Gypsy"*, *"Regal"*, *"Symphony"*, Kokomo, Indiana
"Knight", ALLIED RADIO CORP., Chicago, Ill.
"Kodel", KODEL RADIO CORP.,—(*no longer manufacturing*)
"Kolster", KOLSTER RADIO CORP.—(*no longer manufacturing*)
"Kompakt" (see PHILMORE MFG. CO.)
"Kylectron" (see UNITED REPRODUCERS CORP.)

— L —

LACAULT, R. E. (no longer manufacturing)
"Lafayette", LAFAYETTE RADIO CORP., 100 Sixth Ave., New York, N. Y.
"La France" (private brand of THE FAIR STORE, Chicago, Ill.)
"Lang", LANG RADIO CORP., 3611-14th Ave., Brooklyn, N. Y.—(*no longer manufacturing*)
"La Salle" (1932)—(see BUCKINGHAM RADIO CORP.)
"La Salle" (later)—(see CHAMPION RADIO LABS.)
"La Salle" (Auto Radio), CADILLAC DIVISION, GENERAL MOTORS CORP., Detroit, Michigan
"Laurehk", *"Musique"*, LAUREHK RADIO MFG. CO., 3918 Monroe St., Wayne, Mich.
LEHMAN RADIO SALON, INC., (see PORT-O-MATIC CORP.)
"Lewol", LEWOL MFG. CO.,—(*no longer manufacturing radio sets*)
"Liberty Radio", LIBERTY MUSIC SHOP, 450 Madison Ave., New York, N. Y.
"Lightweight Champion" (see SENTINEL RADIO CORP.)

—(Cont'd on next page)

—(Cont'd from preceding page)

"Lincoln" (*OA*)—made by OZARKA RADIO CORP.—(*no longer manufacturing*)
"Lincoln" (*before 1932*)—LINCOLN RADIO CORP., 154 E. Erie St., Chicago, Ill.—(*no longer manufacturing*)
"Lincoln-Philco" (see PHILCO RADIO & TELEV. CORP.)
"Little Wonder" (see PHILMORE MFG. CO.)
"L'Tatro", *"Tatro"*, L'TATRO MFG. CO., 417 W. Water St., Decorah, Iowa (*no longer manufacturing*), now mf'd. by ECKSTEIN RADIO & TELEV. CO.
"Lullaby" (see MITCHELL MFG. CO.)
"Lumitone" (see MITCHELL Mfg. CO.)
"Luxor", LUXOR RADIO MFG. CO., 521 W. 23 St., New York, N. Y.—(*no longer being manufactured*)
"Lyric" (see ALL AMERICAN MOHAWK CORP.)

— M —

"Macy", *"Supremacy"*, private brands of R. H. MACY & CO., Broadway & 34 St., New York, N. Y.
"Magnavox", MAGNAVOX CO., INC., Fort Wayne, Indiana
"Majesco" (see R-K. RADIO LABS.)
"Majestic" (original), *"Columbia C100,"* GRIGSBY GRUNOW CORP., Chicago, Ill.—(no longer manufacturing)
"Majestic" (current models), *"Case"* (present), reorganized MAJESTIC RADIO & TELEV. CORP., 2650 W. 50 St., Chicago, Ill.
"Mantola", manufactured for GOODRICH by U. S. RADIO & TELEV. CORP., Marion, Indiana
"Marconiphone", MARCONI BROS., INC. (also called MARCONIPHONE CO.), 679 Madison Ave., New York, N. Y.
"Marshall" (*"Plant A"* on license tag)—see CLINTON MFG. CO.
"Marshall" ("RPC" on license tag), see CONTINENTAL RADIO & TELEV. CORP.
"Marvelo" (see RADOLEK CO.)
"Mascot" (see INSULINE CORP. OF AMERICA)
"Masterpiece" (see SILVER, McMURDO, INC.)
"Mayfair", (see CLAGO RADIO CORP.)
"Meissner", MEISSNER MFG. CO., Mt. Carmel, Ill.
"Melrose 41" (see U. S. RADIO & TELEV. CORP.)
MERSMAN BROS. CORP., (*"Brunswick"*), Celina, Ohio
"Midwest", *"Miraco"*, MIDWEST RADIO CORP., Cincinnati, Ohio
"Miraco" (see MIDWEST RADIO CORP.)
"Mission Bell", *"Aeronautic"*, *"Hobbs"*, *"True-Dial"*, MISSION BELL RADIO MFG. CO., 833 Venice Blvd., Los Angeles, Calif.
MITCHELL MFG. CO., (*"Lullaby"*, *"Lumitone"*), 1550 Dayton St., Chicago, Ill.
"Mobilette" (see CALVERT MOTORS ASSOCIATES LTD.)
"Mohawk" (see ALL AMERICAN MOHAWK CORP.)
"Monarch" (see CHAMPION RADIO LABS.)
"Montgomery-Ward", *"Airline"*, *"Coronado"*, *"De Soto"* (home receiver), *"Serenader"*, MONTGOMERY-WARD & CO. private brands, Chicago, Ill.
MOTO-METER GAUGE & EQP'T. CO., (*"Moto-Vox"*)—no longer manufacturing radio receivers

—(Cont'd)

—(Cont'd)

"Motomaster", MOTOMASTER RADIO CO.,—*no longer manufacturing*
"Moto-Master" (see WARWICK MFG. CO.)
"Moto-Midget" (see ACME ELECTRIC & MFG. CO.)
"Motorola" (see GALVIN MFG. CO.)
"Motoset" (see FADA RADIO & ELECTRIC CO.)
"Moto-Vox" (see MOTOMETER GAUGE & EQP'T. CO.)
"Musaphonic" (see GENERAL ELECTRIC CO.)
"Musicaire" (see SENTINEL RADIO CORP.)
"Music Master" (see WARE MFG. CO.)
"Musique" (see LAUREHK RADIO MFG. CO.)

— N —

"Namco", NAMCO MFG. CO., INC., 142 W. 26 St., New York, N. Y.—(*no longer manufacturing*)
"Nash-Philco" (see PHILCO RADIO & TELEV. CORP.)
"National", NATIONAL COMPANY, 61 Sherman St., Malden, Mass.
NATIONAL CARBON CO., (*"Eveready"*)—(no longer manufacturing radio sets)
"National Union", NATIONAL UNION RADIO CORP., 57 State St., Newark, N. J.
"Navigator" (see AC DAYTON)
"New Yorker" (see GRIMES, DAVID, INC.)
"Nightengale" (see CLINTON MFG. CO.)
NOBLITT SPARKS INDUSTRIES, (*"Arvin"*), Columbus, Indiana
"Norco" (see REMLER CO., LT'D.)

— O —

"Oldsmobile" (see GENERAL MOTORS CORP. and UNITED MOTORS SERVICE)
"Operadio", OPERADIO MFG. CO.,—(*no longer manufacturing*)
"Oriole", (see CONTINENTAL RADIO & TELEV.)
"Orpheus" (see SILVER, McMURDO, INC.)
"Ozarka" (original), *"Viking"*, OZARKA RADIO CORP.—(*no longer manufacturing*)
"Ozarka" (present), see VIKING RADIO, and see RADOLEK CO.

— P —

"Pacent", PACENT ENGINEERING CORP., 79 Madison Ave., New York, N. Y.
"Pacific" ("P, or 25" precedes Serial No.), *"American World,"* *"Best"*, *"Buckingham"*, *"World Wide"*, PACIFIC RADIO CORP., 844 W. Adam St., Chicago, Ill.
"Pacific", *"Crusader"*, *"Peerless"* ("25" precedes Serial No.), PACIFIC RADIO CORP., 5016 South Main St., Los Angeles, Calif.
"Packard-Bell", PACKARD-BELL CO., 1318-22 So. Grand Ave., Los Angeles, Calif.

—(Cont'd on next page)

—(Cont'd from preceding page)

"Packard-Philco" (see PHILCO RADIO & TELEV. CORP.)
"Panamuse" (see CAPEHART CORP., INC.)
"Pathe", PATHE RADIO & TELEV. CORP., 2241 S. Indiana Ave., Chicago, Ill.
"Patterson" (old), PATTERSON RADIO CORP., 1320 S. Los Angeles Ave., Los Angeles, Calif.—(*no longer manufacturing*)
"Patterson" (present), PIERSON-DE LANE, INC., 2345 West Washington Blv'd., Los Angeles, Calif.
"Peerless" (original)—(see UNITED REPRODUCERS CORP.)
"Peerless" (present—"25" precedes serial number),—(see PACIFIC RADIO CORP.)
"Pee Wee" (see DETROLA RADIO & TELEV. CORP., also see WESTERN TIRE & AUTO STORES, INC.)
"Pep Boys" (see GALVIN MFG. CORP.)
"Peter Pan" (see JACKSON BELL CO. LT'D.)
PFANSTEIHL PROD. CORP., (*"Baldwin"*)—(no longer manufacturing radio sets)
"Philco", *"Chrysler"*, *"De Soto"*, *"Dodge"*, *"Ford"*, *"Graham"*, *"Hupmobile"*, *"Lincoln"*, *"Nash"*, *"Packard"*, *"Philco"*, *"Pierce Arrow"*, *"Plymouth"*, *"Reo, Studebaker"*, *"Transitone"*, *"Willys-Overland"*), PHILCO RADIO & TELEV. CORP., Tioga & "C" Sts., Philadelphia, Pa.
"Philharmonic", PHILHARMONIC RADIO CO., 21 West 45 St., New York, N. Y.
PHILMORE MFG. CO., (*"Ajax"*, *"Blackbird"*, *"Bluebird"*, *"Kompakt"*, *"Little Wonder"*, *"Supertone"*), 113 University Place, New York, N. Y.
"Pierce Airo", *"De Wald"*, PIERCE AIRO, INC.,—now operated by DE WALD RADIO MFG. CORP., 440 Lafayette St., New York, N. Y.
"Pierce-Arrow-Philco" (see PHILCO RADIO & TELEV. CORP.)
"Pierce Arrow," PIERCE ARROW MOTOR CORP., Buffalo, New York,—(*no longer manufacturing*)
PIERSON-DELANE, INC., (*"Patterson"*), 2345 West Washington Blvd., Los Angeles, Calif.
"Pilgrim", PILGRIM ELECTRIC CORP., 21 West 19 St., New York, N. Y.
"Pilot", PILOT RADIO CORP., 37-06 36 St., Long Island City, N. Y.
"Pioneer" (see RADOLEK CO.)
"Plymouth" (original), PLYMOUTH RADIO CORP.,—(*no longer manufacturing*)
"Plymouth-Philco" (see PHILCO RADIO & TELEV. CORP.)
"Pontiac" (see UNITED MOTORS SERVICE)
"Port-O-Matic", *"Fidel-O-Matic"*, PORT-O-MATIC CORP., 985 Madison Ave., New York, N. Y.
"Pro" (see HAMMARLUND MFG. CO.)

— R —

"Radiette" (see KELLER-FULLER MFG. CO., LTD.)
"Radiobar", RADIOBAR CO. OF AMERICA, 296 Broadway, New York, N. Y.

—(Cont'd)

—(Cont'd)

RADIO CHASSIS MFG. CO., 34 E. 12 St., New York, N. Y. (*no longer manufacturing*)
"Radiochron" (see CLAGO RADIO CORP.)
"Radio Compass" (see HALLICRAFTERS CO.)
"Radiodyne" (see WESTERN COIL & ELECTRICAL CO.)
"Radio-Keg" (see R. K. RADIO LABS., INC.)
"Radiola" (see RCA)
"Radio Master" (see CONTINENTAL RADIO & TELEV. CORP.)
"RME", RADIO MFG. ENGINEERS, INC., 111 Harrison St., Peoria, Ill.
RADIO PRODUCTS CORP., (*"Camden"*, *"Continental"*, *"Co-op" (1938)*, *"Crusader"*, *"Dayrad"*, *"Supertone"*) 3800 W. Cortland St., Chicago, Ill.
RADIO PRODUCTS SALES CO., (*"Clipper"*), 238 W. 15 St., Los Angeles, Calif.—(*no longer manufacturing*)
RADIO TRANSCEIVER LABS., 86-27 115 St., Richmond Hill, New York
"Radiotrope" (see U. S. RADIO & TELEVISION CO.)
RADIO WIRE & TELEVISION, INC., (*"Lafayette"*), 100 Sixth Ave., New York, N. Y.
"Radolek", *"General"*, *"Keystone"*, *"King"*, *"Marvelo"*, *"Ozarka"*, *"Pioneer"*, RADOLEK CO., 601 W. Randolph St., Chicago, Ill., (WALTER C. BRAUN, INC.)
"Ramway" (see ELECTRICAL RESEARCH LABS., INC.)
"Ranger", BROWN & MANHART CO., Los Angeles, Calif.
"Rauland"—RAULAND CORP., 3333 Belmont Ave., Chicago, Ill.—(*no longer manufacturing radio receivers—now manufacturing sound system amplifiers only*)
"RCA", *"RCA-Victor"*, *"Radiola"*, RADIO CORP. OF AMERICA, RCA VICTOR DIVISION, Camden, New Jersey
"Recordio" (see WILCOX-GAY CORP.)
"Regal" (see KINGSTON RADIO CO., INC.)
"Remington" (see DUNN-HALL CO.)
"Remington" (1930-31) (see BUCKINGHAM RADIO CORP.)
"Remler", *"Norco"*, REMLER CO., LT'D., 2101 Bryant St., San Francisco, Calif.
"Reo-Philco" (see PHILCO RADIO & TELEV. CORP.)
"Riverside" (see WARWICK MFG. CO.)
R. K. RADIO LABS., INC., (*"Arkay"*, *"Majesco"*, *"Radio Keg"*,) 6300 Northwest Highway, Chicago, Ill.—(*no longer manufacturing*)
"RME" (see RADIO MFG. ENGINEERS, INC.)
"Road Chief" (see DETROLA RADIO & TELEV. CORP.)
"Road Master" (see DETROLA RADIO & TELEV. CORP.)
"Roamer" (see ALLIED RADIO CORP., and see FIRESTONE TIRE & RUBBER CO.)
"Roamio" (see CROSLEY RADIO CORP.)
ROCK-OLA MFG. CO., 800 N. Kedzie Ave., Chicago, Ill.
"Royal" (before 1932)—see KENNEDY, COLIN B., CO.)
"Royal" (see KING MFG. CORP.)
"Royale", ROYALE RADIO MFG. CO., 1417 W. Pico St., Los Angeles, Calif.—(*no longer manufacturing*)

—(Cont'd on next page)

—(Cont'd from preceding page)

— S —

"*Sargent*", E. M. SARGENT CO., 212-9 St., Oakland, Calif.
SAVIL RADIO ENG. CORP., 24 Wooster St., New York, N. Y.—(*no longer manufacturing*)
"*Scott*", E. H. SCOTT RADIO LABORATORIES, INC., 4450 Ravenswood Ave., Chicago, Ill.
SEARS, ROEBUCK AND COMPANY (private brand "*Silvertone*"), Dept. 657, 925 S. Homan St., Chicago, Ill.
SEEBURG, J. P., CORP., ("*Corona*"), 1500 Dayton St., Chicago, Ill.
"*Serenader*" (see MONTGOMERY WARD & CO.)
"*Sentinel*" (original) (see UNITED AIR CLEANER CO.)
"*Sentinel*" (*current*), "*Burley*", "*Erla*", "*Musicaire*", "*Lightweight Champion*", "*Wings*", SENTINEL RADIO CORP., 2020 Ridge Ave., Evanston, Ill.
"*Setchell Carlson*", "*Doraphone*", SETCHELL CARLSON, INC., 2233 University Ave., St. Paul, Minn.
"*Sheridan*" (see WARWICK MFG. CO.)
"*Showbox*" (see CROSLEY RADIO CORP.)
"*Silver*" (*original*), "*McMurdo Silver*", "*Masterpiece*", "*Orpheus*", McMURDO SILVER CORP., 3354 N. Pauline Ave., Chicago, Ill.—(*no longer manufacturing*)
"*Silver Marshall*', SILVER MARSHALL MFG. CO., 2611 So. Indiana Ave., Chicago, Ill.—(*no longer manufacturing*)
"*Silvertone*" (see SEARS ROEBUCK & COMPANY)
"*Simplex*", SIMPLEX RADIO CO., Monroe & King St., Sandusky. Ohio
"*Sky Buddy*" (1936, 1938),—see HALLICRAFTERS, INC.
"*Sky Challenger*" (see HALLICRAFTERS, INC.)
"*Sky Champion*" (see HALLICRAFTERS, INC.)
"*Sky Chief*" (1937)—(see HALLICRAFTERS, INC.)
"*Sky Chief*" (*present*), "*WOR Receiver*", SKY CHIEF RADIO CORP., 335 E. 27 St., New York, N. Y.
"*Sky Master*" (see HALLICRAFTERS, INC.)
"*Skyrider*" (see HALLICRAFTERS, INC.)
"*Sky Rover*" ("*W. M. Co.*" on license tag)—see WARWICK MFG. CO.
"*Sky Rover*" (*1929-1930*)—see ELECTRICAL RESEARCH LABS., INC.
"*Sky Rover*' ("*WG 24*" on license tag)—see WELLS GARDNER CO.
"*Sky Traveler*" (see HALLICRAFTERS CO.)
"*Slagle*" (see CONTINENTAL RADIO & TELEV. CORP.)
"*Solar*" ("*W. M. Co.*" on license tag)—see WARWICK MFG. CO.
"*Sonora*" (*original*), SONORA PHONOGRAPH CO.—(*no longer manufacturing*)
"*Sonora*" (*present*), SONORA RADIO & TELEV. CORP., 325 N. Hoyne Ave., Chicago, Ill.
SPARKS-WITHINGTON CO., THE, ("*Sparton*"), Jackson, Mich.
"*Sparton*" (see SPARKS-WITHINGTON CO., THE)
SPIEGEL, MAY STERN, "*Air Castle*", "*Supersonic*", Chicago, Ill.
"*Splitdorf*", SPLITDORF RADIO CO.,—(*no longer manufacturing*)
"*Sporter*" (see GALVIN MFG. CORP.)

—(Cont'd)

—(Cont'd)

"*Standard*" ("*W. M. Co.*" *on license tag*)—*see WARWICK MFG. CO.*
"*Starck Classique*" ("*BRC*" on license tag), see BELMONT RADIO CORP.
"*Star-Raider*" (see COMMONWEALTH RADIO MFG. CO.)
"*Steinite*" (*original*), STEINITE RADIO CO.—(*no longer manufacturing*)
"*Steinite*" (*W. M.* on license tag),—see WARWICK MFG. CO.
"*Stewart-Warner*", "*Alemite*", STEWART-WARNER RADIO CORP., 1826 Diversey Parkway, Chicago, Ill.
"*St. Regis*" (see INTERNATIONAL RADIO CORP.)
"*Stromberg-Carlson*", STROMBERG-CARLSON TELEPHONE MFG. CO., 100 Carlson Road, Rochester, N. Y.
"*Studebaker-Philco*" (see PHILCO RADIO & TELEV. CORP.)
"*Sunbeam Radiomaster*" (see CORONA RADIO & TELEV. CORP.)
"*Super-Pro*" (see HAMMARLUND MFG. CO.)
"*Supersonic*" (see SPIEGEL, MAY STERN CO.)
"*Supertone*" (see PHILMORE MFG. CO.)
"*Supertone*" ("*RPC*" on license tag)—see RADIO PRODUCTS CORP.
"*Supertone*" ("*WG24*" on license tag)—see WELLS GARDNER CO.
"*Supremacy*" (see R. H. MACY & CO.)
"*Symphonic*" (see CORONA RADIO & TELEV. CO.—manufactured for WALGREEN DRUG STORES)
"*Symphony*" (GAMBLE-SKOGMO—see KINGSTON RADIO)
"*Syncratone*" (see GAYLORD MFG. CO.)

— T —

"*Tatro*" (see L'TATRO MFG. CO.)
"*TCA*" (see TRANSFORMER CORP. OF AMERICA)
"*Tea Table*" (see WARWICK MFG. CO.)
"*Telex*", TELEX RADIO & TELEV. CO., Chicago, Ill.
"*Telemaco*", TELEPHONE MAINTENANCE CO.,—(*no longer manufacturing*)
"*Temple*" (*original*), TEMPLE RADIO CORP.,—(*no longer manufacturing*)
"*Temple*" (*later*)—see TRANSFORMER CORP. OF AMERICA
"*Templeton*" (see WARWICK MFG. CO.)
"*Templetone*"—see TRANSFORMER CORP. OF AMERICA
"*Tempotone*" (see BARKER BROS.)
"*Tiffany Tone*" (see HORN, HERBERT H.)
"*Tiny Tim*" (see DUNN-HALL CO.)
"*Tobe Tuner*" (see DEUTSCHMANN, TOBE, CORP.)
"*Tom Thumb*" (see AUTOMATIC RADIO MFG. CO., INC.)
"*Tone Master*" ("*W. M. Co.*" on license tag)—see WARWICK MFG. CO.
"*Tone Master*" (see ELECTRICAL RESEARCH LABS.)
TRANSFORMER CORP. OF AMERICA, ("*Clarion*", "*TCA*", "*Temple*", "*Templetone*"), 69 Wooster St., New York, N. Y. (*firm no longer mnfr's. radio sets—now mnfr's. P. A. equipment*)
"*Transitone*" (see PHILCO RADIO & TELEV. CORP.)
TRANSITONE AUTOMOBILE RADIO CORP. (see PHILCO)
"*Travel-Aire*" (see TRAV-LER RADIO & TELEV. CORP.)
"*Trav-Ler*", "*Travel-Air*", TRAV-LER RADIO & TELEV. CORP., 1028 W. Van Buren St., Chicago, Ill.

—(Cont'd on next page)

—(Cont'd from preceding page)

"Trebor", TREBOR RADIO CO., Pasadena, Calif.
"Triangle" (see WESTERN AUTO SUPPLY CO.)
"Troubador" (see ULTRAMAR MFG. CORP.)
"Troubador" (*"W. M. Co."* on license tag)—see WARWICK MFG. CO.
"Troy", TROY RADIO & TELEV. CO., 1144 S. Olive St., Los Angeles, Calif.
"True-Dial" (see MISSION BELL RADIO MFG. CO.)
"Truetest" (see WARWICK MFG. CO.)
"Truetone" (*"BRC"* on license tag)—see BELMONT RADIO CORP., and WESTERN AUTO SUPPLY CO.
"Truetone" (*"W. M. Co."* on license tag)—see WARWICK MFG. CO., and WESTERN AUTO SUPPLY CO.
"Truetone" (*"WG 24"* on license tag)—see WELLS GARDNER CO., and WESTERN AUTO SUPPLY CO.
"Twin 6" (*"W. M. Co."* on license tag)—see WARWICK MFG. CO.

— U —

"Ultramar", *"Troubador"*, ULTRAMAR MFG. CORP., 1160 Howe St., Chicago, Illinois
"Ultra Sky Rider (1937)"—see HALLICRAFTERS, INC.
UNITED AIR CLEANER CO., (*"Sentinel (original)"*—no longer manufacturing
UNITED AMERICAN BOSCH CORP., (*"American-Bosch"*, *"Bosch"*) —*see AMERICAN BOSCH CORP.*
UNITED MOTORS (*"Buick"*, *"B. O. P."*, *"Chevrolet"*, *"Delco"*, *"Oldsmobile"*, *"Pontiac"*), obtain parts from UNITED MOTORS SERVICE, 3044 La Salle St., Chicago, Ill.
UNITED REPRODUCERS CORP., (*"Peerless"* (original), *"Kylectron"*),—no longer manufacturing
UNITED SCIENTIFIC LABS., 440 Lafayette St., New York, N. Y.
"Universal" (*"Plant A"* on license tag)—see CLINTON MFG. CO.
"Universal", UNIVERSAL BATTERY CO., 3410 South La Salle St., Chicago, Ill.
U. S. ELECTRIC CORP., (*"Workrite"*),—no longer manufacturing
U. S. RADIO & TELEVISION CORP., (*"Apex"*, *"Argyle"*, *"Carlton"*, *"Gloritone"*, *"Mantola"*, *"Melrose 41"*, *"Radiotrope"*), Marion, Indiana
U. S. TELEVISION MF'G. CORP., 220 E. 51 St., New York, N. Y.

— V —

"Victory" (see CHAMPION RADIO LABS.)
"Viking" (original),—see OZARKA RADIO CORP.
"Viking" (W. M. Co. on license tag),—see WARWICK MFG. CO.
"Vitatone" (see ZANEY GILL CORP.)
"Vita-Tone" (see GALVIN MFG. CO.)

—(Cont'd)

—(Cont'd)

— W —

"Ware", *"Music Master"*, WARE MFG. CO.,—(*no longer manufacturing*)
"Warwick" (see DETROLA RADIO & TELEV. CORP., see FORDSON EXPORT CORP., see WARWICK MFG. CO.)
"Warwick" (*"W. M. Co."* on license tag), *"All Star"*, *"Arlington"*, *"Auto Tone"*, *"Autra"*, *"Beverly"*, *"Caravan"*, *"Clarion"*, *"Croyden"*, *"De Luxe"*, *"Delta De Luxe"*, *"Dinah"*, *"Druid"*, *"Dual Tone"*, *"Fearnola"*, *"Fidelitone"*, *"General"*, *"Goldentone"*, *"Gold Medal"*, *"Gold Test"*, *"Kingsbury"*, *"Moto-Master"*, *"Riverside"*, *"Sheridan"*, *"Sky Rover"*, *"Solar"*, *"Steinite"*, *"Tea Table"*, *"Templeton"*, *"Tone Master"*, *"Troubador"*, *"Truetest"*, *"Truetone"*, *"Twin 6"*, *"Viking"*, *"Warwick"*, *"Watterson"*, *"Windham"*, *"W. O. R."*—(all with *"W. M. Co."* on license tag)—WARWICK MFG. CO., 1700 Washington Blvd., Chicago, Ill.
"Watterson" (original), WATTERSON RADIO MFG. CO.,—(*no longer manufacturing*)
"Watterson" (*"W. M. Co."* on license tag)—see WARWICK MFG. CO.
"Watterson" (*"25"* precedes Serial No.)—see PACIFIC RADIO CORP.
"Wells-Gardner", *"Arcadia"*, *"Fearnola"*, *"Fidelitone"*, *"Granada"*, *"Great Northern"*, *"Gulbransen"*, *"Hudson"*, *"Sky Rover"* (*WG 24*), *"Supertone"*, *"Truetone"*, *"Whelco"*, WELLS-GARDNER & CO., 2701 N. Kildare Ave., Chicago, Ill.
WESTERN AUTO SUPPLY CO., (private brands, *"General"*, *"General Television"*, *"Triangle"*, *"Truetone"* (*all*), *"Wells-Gardner"*), 2701 Grand St., Kansas City, Missouri
WESTERN COIL & ELECT. CO., (*"Radiodyne"*), 215 State St., Racine, Wisconsin
WESTERN TIRE & AUTO STORES, INC., (private brands *"Endurance"*, *"Pee Wee"*)
"Westinghouse", WESTINGHOUSE ELECT. SUPPLY CO., 150 Varick St., New York, N. Y.
"Westinghouse" (Canadian), CANADIAN WESTINGHOUSE CO., LTD., Hamilton, Ontario, Canada
"Westinghouse International", WESTINGHOUSE ELECTRIC INTERNATIONAL CO., 150 Broadway, New York, N. Y. (This is the Export Division of Westinghouse. *"Whs'e. International"* receivers are sold only in Export Markets, excluding Canada)
"Westminster" (*"Plant A"* on license tag)—see CLINTON MFG. CO.
"Whelco" (see WELLS GARDNER CO.,—made for WHELAN DRUG STORES, Chicago, Ill.)
"White", WHITE WIND ELECTRIC CO., 2300 E. Douglas Ave., Wichita, Kansas
WHOLESALE RADIO SERVICE CO., INC., (*"Lafayette"*), 100 Sixth Ave., New York City
"Wilcox-Gay", *"Recordio"*, WILCOX-GAY CORP., Charlotte, Mich.
"Willys-Overland-Philco" (see PHILCO RADIO & TELEV. CORP.)
"Windsor" (see WARWICK MFG. CO.)

—(Cont'd on next page)

—(Cont'd from preceding page)

"*Wings*" ("*BRC*" on license tag)—(private brand of GOODYEAR SERVICE STORES—manufactured by BELMONT RADIO CORP.)
"*Wings*" ("*E*" on license tag)—(private brand of GOODYEAR SERVICE STORES—manufactured by SENTINEL RADIO CORP.)
"*Wondertone*" (see CONTINENTAL RADIO & TELEV. CORP.)
W.O.R. ("*W. M.*" on license tag),—see WARWICK MFG. CO.
"*WOR Receiver*" (see SKY CHIEF RADIO CORP.)
"*Workrite*" (see U. S. ELECTRIC CORP.)
"*World Wide*" (see PACIFIC RADIO CORP.)
"*Wurlitzer*", RUDOLPH WURLITZER & CO., North Tonawanda, New York

— Y —

"*Yorker*" (see ESPEY MFG. CO.)

— Z —

ZANEY GILL CORP., ("*Vitatone*"),—no longer manufacturing
"*Zenette*" (see ZENITH RADIO CORP.)
"*Zenith*", "*Zenette*", "*Interocean*", ZENITH RADIO CORP., 6001 Dickens Ave., Chicago, Ill.
"*Zephyr*", ZEPHYR RADIO CO., 13139 Hamilton, Detroit, Mich.

—— END ——

DIRECTORY OF TELEVISION RECEIVER (OR KIT) MANUFACTURERS*

AMERICAN TELEVISION CORP., 33 W. 52 St., New York, N. Y.
ANDREA RADIO CORP., D., 48-02 48th Ave., Woodside, New York
CONTINENTAL RADIO & TELEV. CORP., 3800 Cortland St., Chicago, Ill.
CROSLEY MFG. CO., Cincinnati, Ohio
DETROLA RADIO & TELEV., 1501 Beard Ave., Detroit, Mich.
DUMONT LABS., ALLEN B., 2 Main Ave., Passaic, New Jersey
EMERSON RADIO & PHONO CORP., 111-8th Ave., New York, N. Y.
GAROD RADIO CORP., 70 Washington St., Brooklyn, N. Y.
GENERAL ELECTRIC CO., Bridgeport, Conn.
MEISSNER MFG. CO., Mt. Carmel, Ill.
PHILCO RADIO & TELEVISION CORP., Tioga & C Sts., Philadelphia, Pa.
RCA MANUFACTURING CO., Camden, N. J.

—— END ——

DIRECTORY OF RADIO FACSIMILE RECORDER AND RECEIVER MANUFACTURERS*

CROSLEY RADIO CORP., ("*Reado*"), 1329 Arlington St., Cincinnati, Ohio
FINCH TELECOMMUNICATIONS LABS., INC., 4th & Virginia Sts., Passaic, N. J.
"*Reado*" (see CROSLEY RADIO CORP.)

—— END ——

*See Note at bottom of page 709.

MANUFACTURER	Aerials	Batteries	Battery Chargers: Gas Engine Operated	Battery Chargers: Line-Operated	Battery Chargers: Wind-Operated	Cabinets: Metal, & Rack Panels	Cabinets: Plastic Molded	Cabinets: Wood	Clocks, Timers	Earphones	Hardware	Interference Filters	Logs, Maps, Globes, Time Ind'rs.	Phonograph*: Automatic Record Chg'rs.	Phonograph*: Motor & Turntable Units	Phonograph*: Needles (Cutt. & Repro.)	Phonograph*: Records (Commercial)	Phonograph*: Recorders	Phonograph*: Recording Blanks	Phonograph*: Record Players	Power Supply Eqp't.: AC to DC Converters	Power Supply Eqp't.: DC to AC Inverters	Power Supply Eqp't.: Dynamotors	Tubes—(Electronic): Cathode-Ray	Tubes—(Electronic): Phototubes & Photocells	Tubes—(Electronic): Receiving	Tubes—(Electronic): Thyratron & Grid Glow	Tubes—(Electronic): Transmitting	Tuning Dials—Units: Cables & Belts	Tuning Dials—Units: Dials	Tuning Dials—Units: Escutcheons	Tuning Dials—Units: Push-Button Knobs	Tuning Dials—Units: P.B. Tuning Unit Assembly	Tuning Dials—Units: Station Name Cards	Tuning Dials—Units: Tuning Motors	Miscellaneous
A B C Radio Labs., 3334 N. New Jersey St., Indianapolis, Ind.	●																																		
Acme Battery Corp. (*"Acme"*), 59 Pearl St., Brooklyn, N. Y.		●																																	
Acme Specialty Co., 1770 W. Berteau Ave., Chicago, Ill.										●																									
Acton, H. W., Inc., 370 Seventh Ave., New York, N. Y.																●																			
Adler Mfg. Co., 2901 Chestnut St., Louisville Kentucky								●																											
"Advance" (see Gelardin, Inc.)																																			
Aeropower Electric Corp., 621 Jackson Ave., Chicago, Ill.					●																														
Aerovox Corp., New Bedford, Mass.												●																							
Aerowave Antenna Corp., 1132 Michigan Blvd., Chicago, Ill.	●																																		
"Aircell" (see National Carbon Co., Inc.)																																			
"Airline" (see Montgomery Ward Co.)																																			
Alden Corp., Asheville, N. C.								●																											
Alden Products Co., 715 Center St., Brockton, Mass.	●										●																								
Aladdin Radio Industries Inc., 466 W. Superior St., Chicago, Ill.															●			●		●															
Alliance Mfg. Co., (*"Alliance"*), Alliance, Ohio																			●	●															
Allied Radio Corp., 833 W. Jackson Blvd., Chicago, Ill.	●	●																●	●	●															
Allied Recording Prods. Co., 21-09—43rd Ave., Long Island City, N. Y.																																			
Alpha Wire Corp., 50 Howard St., New York, N. Y.	●																																		
American Control Devices Co., 625 Walnut St., Philadelphia, Pa.																																			
American Emblem Co., Utica, N. Y.																																			
American Insul. Corp., New Freedom, Pa.																																			
American Phenolic Corp., 1830 S. 54th St., Chicago, Ill.																																			
American Radio Cabinet Corp., York & Cooper Sts. Camden, N. J.											●																								
American Radio Hardware Co., 476 Broadway, New York, N. Y.	●							●																											
American Tel. & Radio, 300 E. 4th St., St. Paul, Minn.											●											●													
Amperex Electronics Products Inc., 79 Washington St., Brooklyn, N. Y.																					●														
Amplifier Co. of America, 17 W. 20th St., New York, N. Y.																												●							
Amy, Aceves & King, Inc., 11 W. 42nd St., New York, N. Y.	●																			●															
Ansley Radio Corp., 4377 Bronx Boulevard, Bronx, N. Y.																				●															
Arcturus Radio Tube Co., Newark, N. J. (*No longer manufacturing*)																																			
Art Furniture Products Co., Grand Rapids, Mich.								●																											
Associated Attleboro Mfrs., Inc., Attleboro, Mass.							●																												
Auburn Button Works, Auburn, N. Y.							●																												
Audio Development Co., 123 Bryant Ave., N., Minneapolis, Minn.												●																							
Audio Devices, Inc., 1600 Broadway, New York, N. Y.																			●																
Auld, D. L., Co., 5th Ave. & 5th St., Columbus, Ohio																																			
Autocrat Radio Co., 3885 N. Hamilton Ave., Chicago, Ill.																															●				
Automatic Elec. Devices Co., 324 E. 3rd St., Cincinnati, Ohio												●																				●			
Automatic Record Devices Corp., 913 Youngstown Ave., Forest Park, Ill.														●																					
Automatic Winding Co., 900 Passaic Ave., Newark, N. J.																																			
Bakelite Corp., 30 E. 42nd St., New York, N. Y.																																			
Barber Colman Co., Rockford, Ill.							●																												
Bassett Research Co., (*Products now made by E. F. Johnson Co., Waseca, Minn.*)	●																																		
Bastian Bros. Co., 1600 N. Clinton Ave., Rochester, N. Y.																																			
Bateman Sound Systems Co., Akron, Ohio																															●				
Belden Mfg. Co., 4647 W. Van Buren St., Chicago, Ill.	●																	●																	
Birnbach Radio Co., 145 Hudson St., New York, N. Y.	●											●																							
Bodine Elec. Co., 2254 W. Ohio St., Chicago, Ill.											●																	●							
Bogen, David, Co., Inc., 663 Broadway, New York, N. Y.																					●														
Bond Elec. Corp., (*"Bond"*, *"Winchester"*), 146 Munson St., New Haven, Conn.		●																●				●											●		

*See Note at bottom of page 709

—(Continued)

*NOTE: For "Phonograph Pickup" manufacturers see the directory of SOUND AMPLIFIER EQ'PT. MNFR'S.

MANUFACTURER	Aerials	Batteries	Battery Chargers: Gas Engine Operated	Battery Chargers: Line-Operated	Battery Chargers: Wind-Operated	Cabinets: Metal, & Rack Panels	Cabinets: Plastic Molded	Cabinets: Wood	Clocks, Timers	Earphones	Hardware	Interference Filters	Logs, Maps, Globes, Time Ind'rs.	Phonograph*: Automatic Record Chg'rs.	Phonograph*: Motor & Turntable Units	Phonograph*: Needles (Cutt. & Repro.)	Phonograph*: Records (Commercial)	Phonograph*: Recorders	Phonograph*: Recording Blanks	Phonograph*: Record Players	Power Supply Eqp't.: AC to DC Converters	Power Supply Eqp't.: DC to AC Inverters	Power Supply Eqp't.: Dynamotors	Tubes—(Electronic): Cathode-Ray	Tubes—(Electronic): Phototubes & Photocells	Tubes—(Electronic): Receiving	Tubes—(Electronic): Thyratron & Grid Glow	Tubes—(Electronic): Transmitting	Tuning Dials—Units: Cables & Belts	Tuning Dials—Units: Dials	Tuning Dials—Units: Escutcheons	Tuning Dials—Units: Push-Button Knobs	Tuning Dials—Units: P.B. Tuning Unit Assembly	Tuning Dials—Units: Station Name Cards	Tuning Motors	Miscellaneous
Brach, L. S., Mfg. Corp., 55 Dickerson St., Newark, N. J.	●																																		
Bradley Labs. Inc., 82 Meadow St., New Haven, Conn.																																			
Breez-Electric Corp., 450 N. Oakley Blvd., Chicago, Ill.					●																				●										
Bright Star Battery Co., (*"Bright Star"*, *"Eclipse"*, *"Uneed-it"*), Clifton, N. J.		●																																	
Brush Development Co., 3317 Perkins Ave., Cleveland, Ohio										●																									
Bud Radio, Inc., 5205 Cedar Ave., Cleveland, Ohio						●					●	●																	●						
Burgess Battery Co., (*"Burgess"*), Freeport, Ill.		●																																	
Burton-Rogers Co., 857 Boylston Ave., Boston, Mass.	●																																		
Cabinet Mfg. Co., 1965 N. Magnolia Ave., Chicago, Ill.								●																											
Camburn Elect. Prod. Ind., 490 Broome St., New York, N. Y.	●																																		
Cannon, C. F., Co., Springwater, N. Y.										●																									
Capehart Inc., Fort Wayne, Ind.														●																					
Carron Mfg. Co., 415 S. Aberdeen St., Chicago, Ill.										●						●		●	●																
Carter Motor Co., 1608 Milwaukee Ave., Chicago, Ill.																					●		●												
Castlewood Products Corp., Louisville, Kentucky								●																											
Caswell Runyan Co., Huntington, Ind.								●																											
Cathode Ray & Television Tube Co., Brockton, Mass.																								●											
Champion Radio Works, Danvers, Mass.																																			
Charlotte Furniture Co., Charlotte, Mich.								●																		●									
Chicago Molded Prod. Corp., 1024 North Kolmar, Chicago, Ill.							●																								●				
Chicago Telephone Supply Co. (*"Frost"*), Elkhart, Ind.										●																									
Chillicothe Furniture Co., Chillicothe, Mo.								●																											
Churchill Cabinet Co., 2121 Churchill St., Chicago, Ill.								●																											
Cinch Mfg. Corp., 2335 W. Van Buren St., Chicago, Ill.											●																								
Cleartone Elect. Corp., 35 Shultz Ave., Cleveland, Ohio												●																							
Coils, Inc., Providence, R. I.																														●					
Communication Products Co., 245 Custer Ave., Jersey City, N. J.	●																																		
Collins Radio Co., 2920 First Ave., Cedar Rapids, Iowa			●			●																						●							
Columbia Recording Corp., 1473 Barnum Ave., Bridgeport, Conn.																	●																		
Consolidated Records, Inc., 1600 Broadway, New York, N. Y.																			●																
Consolidated Wire & Assoc. Corps., 1635 S. Clinton St., Chicago, Ill.	●											●						●																	
Continental Carbon Inc., 13900 Lorain Ave., Cleveland, Ohio												●																		●					
Continental Electric Co., Geneva, Ill.																									●		●								
Continental Motors Corp., 12801 E. Jefferson St., Detroit, Mich.			●																																
Continental Music Co., Inc., 630 S. Wabash Ave., Chicago, Ill.																		●																	
Corbett Cabinet Mfg. Co., St. Marys, Pa.								●																											
Cornell Dubilier Elect. Corp., 1003 Hamilton Blvd., So. Plainfield, N. J.												●																							
Cornish Wire Co., 15 Park Row, New York, N. Y.	●																																		
Cram, George F., Co., 30 E. Georgia St., Indianapolis, Ind.													●																						
Crosley Corp., Cincinnati, Ohio																		●									●								
Crowe Name Plate & Mfg. Co., 3701 Ravenswood Ave., Chicago, Ill.																													●	●	●	●			
Cunningham Mfg. Co., Camden, N. J.																											●								
Davies, H., Molding Co., 1428 N. Wells St., Chicago, Ill.																														●					
Decca Records Inc., 50 W. 57th St., New York, N. Y.																	●																		
Delco Appliance Div., General Motors Sales Corp., 391 Lyell Ave., Rochester, N. Y.																																		●	
Delco-Remy, Anderson, Ind.		●																																	
Deutschmann, Tobe, Corp., Canton, Mass.	●											●																							
DeWald Radio Mfg. Co., 440 Lafayette St., New York, N. Y.																		●																	
Dictograph Prod. Co., Inc., 580 Fifth Ave., New York, N. Y.										●																									

—(Continued)

*NOTE: For "Phonograph Pickup" manufacturers see the directory of SOUND AMPLIFIER EQ'PT. MNFR'S.

MANUFACTURER	Aerials	Batteries	Battery Chargers: Gas Engine Operated	Battery Chargers: Line-Operated	Battery Chargers: Wind-Operated	Cabinets: Metal, & Rack Panels	Cabinets: Plastic Molded	Cabinets: Wood	Clocks, Timers	Earphones	Hardware	Interference Filters	Logs, Maps, Globes, Time Ind'rs.	Phonograph*: Automatic Record Chg'rs.	Phonograph*: Motor & Turntable Units	Phonograph*: Needles (Cutt. & Repro.)	Phonograph*: Records (Commercial)	Phonograph*: Recorders	Phonograph*: Recording Blanks	Phonograph*: Record Players	Power Supply Eqp't.: AC to DC Converters	Power Supply Eqp't.: DC to AC Inverters	Power Supply Eqp't.: Dynamotors	Tubes—(Electronic): Cathode-Ray	Tubes—(Electronic): Phototubes & Photocells	Tubes—(Electronic): Receiving	Tubes—(Electronic): Thyratron & Grid Glow	Tubes—(Electronic): Transmitting	Tuning Dials—Units: Cables & Belts	Tuning Dials—Units: Dials	Tuning Dials—Units: Escutcheons	Tuning Dials—Units: Push-Button Knobs	Tuning Dials—Units: P.B. Tuning Unit Assembly	Tuning Dials—Units: Station Name Cards	Tuning Dials—Units: Tuning Motors	Miscellaneous
Diehl Mfg. Co., Elizabethport, N. J.																																			
D. & H. Mfg. Co., Inc., 18 W. Irvington Pl., Denver, Col.	●														●					●															
Dual Remote Control Co., 31776 W. Warren Ave., Wayne, Mich.																																			
Du Mont, Allen B., Laboratories, Inc., 2 Main Ave., Passaic, N. J.																								●					●						
Dumont Elect. Co., Inc., 514 Broadway, New York, N. Y.												●																							
Eagle Elect. Mfg. Co., 59 Hall St., Brooklyn, N. Y.	●																																		
Eagle Signal Corp., Moline, Ill.									●																										
Eby, Hugh H., Inc., 4700 Stenton Ave., Philadelphia, Pa.																									●				●						
"Eclipse" (see Bright Star Battery Co.)																																			
Eitel-McCullough, Inc., (*"Eimac"*), 798 San Matteo Ave. San Bruno, Cal.																																			
Eicor, Inc., 1501 W. Congress St., Chicago, Ill.																												●							
Elect. Industries Mfg. Co., Red Bank, N. J.																						●											●		
Electric Specialty Co., Stamford, Conn.														●					●																
Electric Storage Battery Co., (*"Exide"*), Allegheny Ave. & 19th St., Philadelphia, Pa.		●																			●		●												
Electro Acoustic Pdts., 2131 Beuter Rd., Fort Wayne, Ind.																			●																
Electro Products Lab., 549 W. Randolph St., Chicago, Ill.				●																															
Electronic Labs., 122 W. New York St., Indianapolis, Ind.																																			
Electronic Products Co., 5356 E. Ninth St., Los Angeles, Cal.																					●														
Electrovox Co., 356 Glenwood Ave., East Orange, N. J.																									●			●							
Emeloid Co., Inc., 287 Laurel Ave., Arlington, N. J.																●		●																	
Emerson Radio & Phonograph Corp., 111 Eighth Ave., New York, N. Y.	●																	●																	
Erie Resistor Corp., (*"Erie"*), 644 W. 12th t., Erie, Pa.																		●	●							●									
Erwood Sound Equip. Co., 223 W. Erie St., Chicago, Ill.																																			
"Everready" (see National Carbon Co.)														●						●															
"Exide" (see Electric Storage Battery Co.)																																			
Fada Radio & Elect. Co., Inc., 30-20 Thomson Ave., Long Island City, N. Y.	●																																		
F. & H. Radio Labs., Fargo, N. D.	●																																		
Fairchild Aerial Camera Corp., 88-06 Van Wyck Blvd., Jamaica, N. Y.																		●	●																
Fairchild Aviation Corp., 88-06 Van Wyck Blvd., Jamaica, N. Y.																			●																
Farnsworth Radio & Telev. Corp., Fort Wayne, Ind.	●													●				●						●											
Favorite Mfg. Co., 105 E. 12th St., New York, N. Y.																	●																		
Federal Recorder Co., Inc., 50 W. 57th St., New York, N. Y.																●																			
Federal-Telegraph Co., 200 Mt. Pleasant Ave., Newark, N. J.																		●	●																
Ferranti Elect., Inc., 30 Rockefeller Plaza, New York, N. Y.																												●							
Fidelitone Records, Inc., 1463 Lake St., Chicago, Ill. (*No longer mf'g.*)												●																							
Fishwick Radio Co., 139 W. 4th St., Cincinnati, Ohio	●																																		
Fleron, M. M., & Sons, 113 No. Broad St., Trenton, N. J.	●																																		
Foreman, W. D., 5359 State St., Chicago, Ill.				●																															
Fox Sound Equip. Corp., 3220 Monroe St., Toledo, Ohio																			●																
Galvin Mfg. Corp., (*"Motorola"*), 4545 Augusta Blvd., Chicago, Ill.	●													●				●																	
Garrard Sales Corp., 296 Broadway, New York, N. Y.														●	●																				
Gelardin, Inc., ("ABC"), ("Advance"), 25 Washington St., Brooklyn, N. Y. (*No longer mf'g.*)		●																																	
Gemloid Corp., (*"Gemloid"*), 79-26 Albion Ave., Elmburst, N. Y.																																			
General Cement Mfg. Co., Rockford, Ill.																																●			
General Dry Batteries, Inc., (*"General"*), 13000 Athens Ave., Cleveland, Ohio		●																										●	●			●			

—(Continued)

*NOTE: For "Phonograph Pickup" manufacturers see the directory of SOUND AMPLIFIER EQ'PT. MNFR'S.

MANUFACTURER	Aerials	Batteries	Battery Chargers: Gas Engine Operated	Battery Chargers: Line-Operated	Battery Chargers: Wind-Operated	Cabinets: Metal, & Rack Panels	Cabinets: Plastic Molded	Cabinets: Wood	Clocks, Timers	Earphones	Hardware	Interference Filters	Logs, Maps, Globes, Time Ind'rs.	Phonograph*: Automatic Record Chg'rs.	Phonograph*: Motor & Turntable Units	Phonograph*: Needles (Cutt. & Repro.)	Phonograph*: Records (Commercial)	Phonograph*: Recorders	Phonograph*: Recording Blanks	Phonograph*: Record Players	Power Supply Eqp't.: AC to DC Converters	Power Supply Eqp't.: DC to AC Inverters	Power Supply Eqp't.: Dynamotors	Tubes—(Electronic): Cathode-Ray	Tubes—(Electronic): Phototubes & Photocells	Tubes—(Electronic): Receiving	Tubes—(Electronic): Thyratron & Grid Glow	Tubes—(Electronic): Transmitting	Tuning Dials—Units: Cables & Belts	Tuning Dials—Units: Dials	Tuning Dials—Units: Escutcheons	Tuning Dials—Units: Push-Button Knobs	Tuning Dials—Units: P.B. Tuning Unit Assembly	Tuning Dials—Units: Station Name Cards	Tuning Dials—Units: Tuning Motors	Miscellaneous
General Electric Co., Bridgeport, Conn.	●								●						●				●					●												
General Electric Company, Schenectady, N. Y.				●																				●	●	●	●	●							●	
General Industries Co., Elyria, Ohio														●	●			●	●																	
General Instrument Corp., 829 Newark Ave., Elizabeth, N. J.																																	●			
General Plastics, Inc., North Tonawanda, N. Y.							●																													
General Radio Co., 30 State St., Cambridge, Mass.																														●						
General Record Co., 1600 Broadway, New York, N. Y.																	●		●																	
General Transformer Corp., 1250 W. Van Buren St., Chicago, Ill.																				●																
General Winding Co., 254 W. 31st St., New York, N. Y.	●																																			
Gibbs, Thomas B., 900 W. Lake St., Chicago, Ill.																		●	●	●																
Gilbert Clock Co., Winsted, Conn.									●																											
Girard-Hopkins, 1437—23rd Ave., Oakland, Cal.												●																								
Gits Molding Corp., 4600 W. Huron St., Chicago, Ill.																														●		●				
Globe-Union, Inc., ("*Globe Union*"), 900 E. Keefe Ave., Milwaukee, Wisc.		●																																		
G-M Laboratories, Inc., 4314-26 No. Knox Ave., Chicago, Ill.																									●											
Goat Metal Stampings, Inc., 314 Dean St., Brooklyn, N. Y.											●																									
Gordon Specialities Co., 1104 S. Wabash Ave., Chicago, Il.									●				●																	●						
Gorr, Carl, Printing Co., 2615 N. Ashland Ave., Chicago, Ill.													●																				●			
Gould-Moody Corp., 395 Broadway, New York, N. Y.																			●																	
Greco Cabinet Co., 48 Mangin St., Brooklyn, N. Y.								●																												
Guthman, Edwin, & Co., Inc., 400 So. Peoria St., Chicago, Ill.																																	●			
Hall Radio Co., 387 Diversey Blvd., Chicago, Ill.																														●			●			
Hammarlund Mfg. Co., Inc., 424 W. 33rd St., New York, N. Y.						●																								●			●			
Hammermill Paper Co., Plastics Division, Erie, Pa.																			●																	
Hanson Mfg. Co., Princeton, Ind.									●																											
Hardray Inc., 524 West Broadway, New York, N. Y.														●																						
Haydon Mfg. Co., Inc., Forestville, Conn.																																				
Haynes Radio Log, 161 W. Harrison St., Chicago, Ill.													●																							
Heintz & Kaufman, Ltd., ("*Gammatron*"), South San Francisco, Cal.																																	●			
Hetro Elect. Indust., Inc., 4611 Ravenswood Ave., Chicago, Ill.			●		●																															
Heyer Products Co., Inc., 471 Cortlandt St., Belleville, N. J.				●																													●			
Holtzer-Cabot Elect. Co., 125 Amory St., Boston, Mass.																																				
Home Furniture Co., York, Pa.								●																												
Home Recording Co., 54 East 11th St., New York, N. Y.																			●																	
Howard Radio Co., 1735 Belmont Ave., Chicago, Ill.																		●	●																	
Hygrade Sylvania Corp., Emporium, Pa. (*now Sylvania Elec. Prod. Inc.*)																								●		●		●								
Hytron Corp., 76 Lafayette St., Salem, Mass.																								●		●		●								
Imperial Moulded Prod. Corp., 2927 W. Harrison St., Chicago, Ill.																																●				
Industrial Timer Corp., 101 Edison Pl., Newark, N. J.									●																											
Inland Mfg. Div., General Motors Corp., 14 Coleman Ave., Dayton, Ohio	●																													●		●				
Insuline Corp. of America, 30-30 Northern Blvd., Long Island City, N.Y.	●					●				●	●	●																								
James Vibrapowr Co., 341 N. Crawford Ave., Chicago, Ill.																					●	●														
Janette Mfg. Co., 556-558 W. Monroe St., Chicago, Ill.			●									●																								
J. F. D. Mfg. Co., 4109 Ft. Hamilton Parkway, Brooklyn, N. Y.	●										●								●																	
Johnson, E. F., Co., Waseca, Minn.	●																													●						
Johnson Motors Co., 1930 Pershing Road, Waukegan, Ill.			●																																	
Jumbo Battery Mfrs. ("Jumbo"), Ellsworth, Iowa		●																																		
Kato Engineering Co., 727 S. Front St., Mankato, Minn.			●																	●																

*NOTE: For "Phonograph Pickups" manufacturers see the directory of SOUND AMPLIFIER EQ'PT. MNFR'S.

—(Continued)

MANUFACTURER	Aerials	Batteries	Battery Chargers: Gas Engine Operated	Battery Chargers: Line-Operated	Battery Chargers: Wind-Operated	Cabinets: Metal, & Rack Panels	Cabinets: Plastic Molded	Cabinets: Wood	Clocks, Timers	Earphones	Hardware	Interference Filters	Logs, Maps, Globes, Time Ind'rs.	Phonograph*: Automatic Record Chg'rs.	Phonograph*: Motor & Turntable Units	Phonograph*: Needles (Cutt. & Repro.)	Phonograph*: Records (Commercial)	Phonograph*: Recorders	Phonograph*: Recording Blanks	Phonograph*: Record Players	Power Supply Eqp't.: AC to DC Converters	Power Supply Eqp't.: DC to AC Inverters	Power Supply Eqp't.: Dynamotors	Tubes—(Electronic): Cathode-Ray	Tubes—(Electronic): Phototubes & Photocells	Tubes—(Electronic): Receiving	Tubes—(Electronic): Thyratron & Grid Glow	Tubes—(Electronic): Transmitting	Tuning Dials—Units: Cables & Belts	Tuning Dials—Units: Dials	Tuning Dials—Units: Escutcheons	Tuning Dials—Units: Push-Button Knobs	Tuning Dials—Units: P.B. Tuning Unit Assembly	Station Name Cards	Tuning Motors	Miscellaneous
Kellogg Switchboard & Supply Co., 6650 S. Cicero Ave., Chicago, Ill.										●																									
Ken-Rad Tube & Lamp Corp., Inc., Owensboro, Kentucky																																			
Kenyon Molding Corp., 1122 No. Wells St., Chicago, Ill.																									●										
"Knight" (see Allied Radio Corp.)																																			
Koulish-Meyer Co., Inc., 64 Fulton St., New York, N. Y.																●																			
Kurz-Kash Co., Dayton, Ohio																															●				
Lafayette Radio Corp., 100 Sixth Ave., New York, N. Y.																																			
Lanson Co., New Holstein, Wisconsin			●																●																
Laurehk Radio Mfg. Co., 3918 Monroe St., Wayne, Mich.	●																																		
"Layerbilt" (see National Carbon Co. Inc.)																																			
Lenz Elect. Mfg. Co., 1751 N. Western Ave., Chicago, Ill.	●																																		
Lifetime Corp., 1825 Adams St., Toledo, Ohio																																			
Lingo, J. E., & Son, Inc., Camden, N. J.	●																		●																
Littlefuse, Inc., 4757 Ravenswood Ave., Chicago, Ill.											●																								
Loewenberg, F., 10 E. 40th St., New York, N. Y.																									●										
Luce Furn. Corp., 655 Godfrey Ave., S.W., Grand Rapids, Mich.								●																											
Lumalite Dial Co., 1463 So. Michigan Ave., Chicago, Ill.																														●					
Mallory, P. R., & Co., Inc. (*"Yaxley"*), (*"Mallory"*), Indianapolis, Ind.				●								●									●													
Manufacturers Screw & Supply House, 215 W. Illinois St., Chicago, Ill.											●								●												●	●			
Marathon Battery Co., Warsaw, Wisc.		●																																	
Marconiphone Co., 679 Madison Ave., New York, N. Y.																			●																
Mark Simpson Mfg. Co., 186 W. 4th St., New York, N. Y.																			●																
Meck, John, Industries, Liberty & Penn. Aves., Plymouth, Ind.																			●																
Meissner Mfg. Co., Mt. Carmel, Ill.						●						●						●																	
Mercury Elect. Co., 1045 Washington Blvd., Chicago, Ill.			●																												●				
Melburn Radio Mfg. Co., 2218 S. Hoover St., Los Angeles, Cal.								●																											
Microtube Labs., 2414 Lawrence Ave., Chicago, Ill.																									●										
Miles Reproducer Co., 812 Broadway, New York, N. Y.																			●																
Milford Rivet Co., Milford, Conn.											●																								
Milfred Mfg. Co., 757 Venice Blvd., Los Angeles, Cal.													●																						
Millen, James, Mfg. Co., Malden, Mass.						●																													
Miller, J. W., Co., 5917 S. Main St., Los Angeles, Cal.												●																		●					
"Mini-max" (see National Carbon Co., Inc.)																														●			●		
Mirror Record Corporation, 58 W. 25th St., New York, N. Y.																●			●																
Monark Battery Co., Inc., (*"Monark"*), 4556 W. Grand Ave., Chicago, Ill.		●																																	
Montgomery Ward & Co., (*"Airline"*), Chicago, Ill.		●																																	
Mueller Elect. Co., 1573 E. 31st St., Cleveland, Ohio											●																								
Murdock Mfg. Co., Boston, Mass.										●																									
Musicraft Records, Inc., 242 W. 55th St., New York, N. Y.																	●		●																
Muter Co., 1255 S. Michigan Ave., Chicago, Ill.												●																				●			
National Co., 61 Sherman St., Malden, Mass.						●																													
National Carbon Co., Inc., (*"Aircell"*, *"Eveready"*, *"Layerbilt"*, *"Mini-max"*), 30 E. 42nd St., New York, N. Y.		●																												●					
National Lock Washer Co., 65 Johnson St., Newark, N. J.											●																								
National Radio Tube Co., Inc., 3420—18th St., San Francisco, Cal.																																			
National Union Radio Corp., (*"National Union"*), 57 State St., Newark, N. J.		●																																	
New Haven Clock Co., 133 Hamilton St., New Haven, Conn.									●															●	●	●		●							
New Products Corp., Benton Harbor, Mich.													●																						

—(Continued)

*NOTE: For "Phonograph Pickups" manufacturers see the directory of SOUND AMPLIFIER EQ'PT. MNFR'S

MANUFACTURER	Aerials	Batteries	Battery Chargers: Gas Engine Operated	Battery Chargers: Line-Operated	Battery Chargers: Wind-Operated	Cabinets: Metal, & Rack Panels	Cabinets: Plastic Molded	Cabinets: Wood	Clocks, Timers	Earphones	Hardware	Interference Filters	Logs, Maps, Globes, Time Ind'rs.	Phonograph*: Automatic Record Chg'rs.	Phonograph*: Motor & Turntable Units	Phonograph*: Needles (Cutt. & Repro.)	Phonograph*: Records (Commercial)	Phonograph*: Recorders	Phonograph*: Recording Blanks	Phonograph*: Record Players	Power Supply Eqp't.: AC to DC Converters	Power Supply Eqp't.: DC to AC Inverters	Power Supply Eqp't.: Dynamotors	Tubes—(Electronic): Cathode-Ray	Tubes—(Electronic): Phototubes & Photocells	Tubes—(Electronic): Receiving	Tubes—(Electronic): Thyratron & Grid Glow	Tubes—(Electronic): Transmitting	Tuning Dials—Units: Cables & Belts	Tuning Dials—Units: Dials	Tuning Dials—Units: Escutcheons	Tuning Dials—Units: Push-Button Knobs	Tuning Dials—Units: P.B. Tuning Unit Assembly	Tuning Dials—Units: Station Name Cards	Tuning Dials—Units: Tuning Motors	Miscellaneous
Noblitt-Sparks Industries, Inc., Columbus, Indiana	●																																		
Norwest Radio Labs., 3454 Fullerton Ave., Chicago, Ill.	●																																		
Oak Mfg. Co., 711 W. Lake St., Chicago, Ill.																																			
Ohmite Mfg. Co., 4835 Flournoy St., Chicago, Ill.												●																					●		
Onan, D. W., & Sons, 634 Royalston Ave., Minneapolis, Minn.			●																																
Operadio Mfg. Co., St. Charles, Ill.																				●															
Pacent Engineering Corp., 79 Madison Ave., New York, N. Y.												●			●					●															
Parker-Kalon Corp., 200 Varick St., New York, N. Y.											●																								
Par Metal Products Corp., 3262—49th St., Long Island City, N. Y.						●																													
Parris-Dunn Corp., Clarinda, Iowa					●														●																
Peerless Album Co., 38 W. 21st St., New York, N. Y.																																			
Perfection Products Corp., 931 Paul Ave., Wichita, Kans.	●																																		
Permo Products Corp., 6415 Ravenswood Ave., Chicago, Ill.																●			●																
Pfanstiehl Chemical Co., 103 Lake View Ave., Waukegan, Ill.																●																			
Pheoll Mfg. Co., 80 Walker St., New York, N. Y.											●																								
Philco Radio & Telev. Corp., ("*Philco*"), Tioga & C Sts., Phila., Pa.	●	●								●	●	●				●			●	●	●				●			●			●				
Philmore Mfg. Co., Inc., 113 University Place, New York, N. Y.	●									●		●																							
Philson Mfg. Co., 156 Chambers St., New York, N. Y.	●																																		
Phonomotor Corp., 623 Diversey Blvd., Chicago, Ill.															●																				
Pioneer Gen-E-Motor Corp., 466 W. Superior St., Chicago, Ill.			●																		●		●												
Pioneer Spec. Co., 521 St. Jean Ave., Chicago, Ill.	●																																		
Play-o-phono Corp., 197 N. Worth St., Chicago, Ill.																				●															
Porcelain Products, Inc., 124 W. Front St., Findlay, Ohio	●																																		
Port-O-Matic Corp., 985 Madison Ave., New York, N. Y.																				●															
Port-O-Power Mfg. Co., 263 Lake St., Chicago, Ill.			●																																
Premax Sales Div., Chisholm-Ryder Co., Niagara Falls, N. Y.	●				●																														
Presto Recording Corp., 242 W. 55th St., New York, N. Y.																●			●	●															
Proctor, B. A., Co., Inc., 230 Park Ave., New York, N. Y.																				●															
Quality Cabinet Corp., Peru, Indiana								●																											
Radiart Corp., W. 62nd St. & Barberton Ave., Cleveland, Ohio	●																				●														
Radio Elect. Service, 1918 Newton St., Saginaw, Mich.	●								●																										
Radio & Technical Publishing Co., 45 Astor Place, New York, N. Y.													●																						
Radiotone, Inc., 7356 Melrose Ave., Hollywood, Cal.																●																			
Radolek Co., 601 W. Randolph St., Chicago, Ill.	●																																		
Rangertone, Inc., 201 Verona Ave., Newark, N. J.																●																			
Ray-o-Vac Co. ("*Ray-o-Vac*"), Madison, Wisc.		●																																	
Raytheon Production Corp., 420 Lexington Ave., New York, N. Y.																										●	●								
Radio Corp. of America, RCA Victor Division, Camden, N. J.	●										●	●		●	●	●		●	●	●	●			●	●	●	●	●		●					
RCA Mfg. Co., Inc., (RCA Radiotron Division), Harrison, N. J.																										●									
Recordisc Corp., 395 Broadway, New York, N. Y.																			●																
Recoton Corp., 21-10 49th Ave., Long Island City, N. Y.																●																			
Red Lion Cabinet Co., Red Lion, Pa.								●																											
Regal Amplifier Mfg. Corp., 14-16 W. 17th St., New York, N. Y.																				●															
Rek-o-Kut Corp., 254 Canal St., New York, N. Y.															●			●																	
Remler Co., Ltd., 2101 Bryant St., San Francisco, Cal.																		●																	
Rhodes, M. H., Inc., 41 Warren St., New York, N. Y.									●																										
Richardson Co., 2738 Lake St., Melrose Prk., Chicago, Ill.						●																													
Rivard Wire & Cable Corp., 1014 Madison Ave., Toledo, Ohio	●																																		
Rock-Ola Mfg. Corp., 800 N. Kedzie Ave., Chicago, Ill.																		●	●																

—(Continued)

*NOTE: For "Phonograph Pickups" manufacturers see the directory of SOUND AMPLIFIER EQ'PT. MNFR'S.

MANUFACTURER	Aerials	Batteries	Battery Chargers: Gas Engine Operated	Battery Chargers: Line-Operated	Battery Chargers: Wind-Operated	Cabinets: Metal, & Rack Panels	Cabinets: Plastic Molded	Cabinets: Wood	Clocks, Timers	Earphones	Hardware	Interference Filters	Logs, Maps, Globes, Time Ind'rs.	Phonograph*: Automatic Record Chg'rs.	Phonograph*: Motor & Turntable Units	Phonograph*: Needles (Curt. & Repro.)	Phonograph*: Records (Commercial)	Phonograph*: Recorders	Phonograph*: Recording Blanks	Phonograph*: Record Players	Power Supply Eqp't.: AC to DC Converters	Power Supply Eqp't.: DC to AC Inverters	Power Supply Eqp't.: Dynamotors	Tubes—(Electronic): Cathode-Ray	Tubes—(Electronic): Phototubes & Photocells	Tubes—(Electronic): Receiving	Tubes—(Electronic): Thyratron & Grid Glow	Tubes—(Electronic): Transmitting	Tuning Dials—Units: Cables & Belts	Tuning Dials—Units: Dials	Tuning Dials—Units: Escutcheons	Tuning Dials—Units: Push-Button Knobs	Tuning Dials—Units: P.B. Tuning Unit Assembly	Tuning Dials—Units: Station Name Cards	Tuning Dials—Units: Tuning Motors	Miscellaneous
Rotomotors Converter Corp., 932 Harrison St., Newark, N. J.																							●													
Ruralite Engineering Co., Sioux City, Iowa					●																															
Schiffman Bros., 3840 N. Ashland Ave., Chicago, Ill.	●																																			
Schloss Bros., 801 E. 135th St., New York, N. Y.								●																												
Seeburg, J. P., Corp., 1500 Dayton St., Chicago, Ill.														●				●																		
Sentinel Radio Corp., 2020 Ridge Ave., Evanston, Ill.	●		●		●													●																		
Sessions Clock Co., Forestville, Conn.									●																											
Setchell-Carlson Inc., 2233 University Ave., St. Paul, Minn.																				●																
Shakeproof Lock Washer Co., 2539 N. Keeler Ave., Chicago, Ill.											●																									
Sheet Metal Specialty Co., 1417 W. Pico St., Los Angeles, Cal.																														●						
Silenco Filter Corp., 249 Parker Ave., Chicago, Ill.												●																								
Sillcox Radio & Telev. Corp., 70 Pine St., New York, N. Y.		●																																		
Sky Pilot Organization, Radio Park, Pearl River, N. Y.									●				●																							
Snyder, Inc., 813 Noble St., Philadelphia, Pa.	●																																			
Solar Mfg. Corp., 586 Avenue A, Bayonne, N. J.												●																								
Sonata Mfg. Co., 410 E. 32nd St., New York, N. Y.								●																												
Sound Apparatus Co., 150 West 46th St., New York, N. Y.																		●	●																	
Sound Devices Co., 160 E. 116th St., New York, N. Y.																			●																	
Sparks-Withington Co., Jackson, Mich.	●																																			
Speak-o-Phone Recording & Equipment Co., 23 W. 60th St., New York, N. Y.																		●	●																	
Speedy-Q Record Co., 67 W. 44th St., New York, N. Y. and 1344 S. Flower St., Los Angeles, Cal. (*"Sound Effects" Records*)																	●																		
Sprague Products Co., North Adams, Mass.												●																								
Star Machine Mfg., Inc., 1371 E. Bay Ave., New York, N. Y.																														●						
Standard Transformer Corp., 1500 N. Halstead St., Chicago, Ill.																					●															
Steger Furniture Mfg. Co., Steger, Ill.								●																												
Stewart, F. W., Mfg. Corp., (*"Stewart"*), 340 W. Huron St., Chicago, Ill.																														●		●	●			
Stewart-Warner Corp., 1826 Diversey Parkway, Chicago, Ill.																		●																		
Stromberg-Carlson Tel. Mfg. Co., 100 Carlson Road, Rochester, N. Y.	●														●					●																
Sundt Engineering Co., 4757 Ravenswood Ave., Chicago, Ill. (*Carillon Records*)																	●																			
Swartzbaugh, The, Mfg. Co., Toledo, Ohio									●																											
Talk-A-Phone Mfg., 1219 W. Van Buren, Chicago, Ill.																				●																
Taylor Tubes, Inc., 2341 Wabansia Ave., Chicago, Ill.																												●								
Technical Appliance Corp., 516 W. 34th St., New York, N. Y.	●											●																								
Television Tube Products Corp., 929 Keystone Ave., Pittsburgh, Pa.																								●												
Thomas, Seth, Clock Co., Thomaston, Conn.									●																											
Thompson, H. C., Clock Co., Bristol, Conn.									●																											
Tichenor Co., 7323 W. Chicago Blvd., Chicago, Ill.	●																																			
Tillotson Furniture Corp., Jamestown, N. Y.								●																												
Tobe Deutschmann Corp. (see Deutschmann, Tobe Corp., Canton, Mass.)																																				
Todd Products Co., 179 Wooster St., New York, N. Y.				●																																
Tonk Mfg. Co., 1912 N. Magnolia Ave., Chicago, Ill.								●																												
Tork Clock Co., Mt. Vernon, N. Y.									●																											
Triad Mfg. Co., Inc., Pawtucket, R. I.																										●										
Triangle Radio Tubes, Inc., Newark, N. J.																										●										
Trimm Radio Mfg. Co., 1770 W. Berteau Ave., Chicago, Ill.										●																										
Triple-A-Specialties Co., 2109 Walnut St., Chicago, Ill.				●																																
Tubular Rivet & Stud Co., Boston, Mass.											●																									

—(Continued)

*NOTE: For "Phonograph Pickups" manufacturers see the directory of SOUND AMPLIFIER EQ'PT. MNFR'S

MANUFACTURER	Aerials	Batteries	Battery Chargers: Gas Engine Operated	Battery Chargers: Line-Operated	Battery Chargers: Wind-Operated	Cabinets: Metal, & Rack Panels	Cabinets: Plastic Molded	Cabinets: Wood	Clocks, Timers	Earphones	Hardware	Interference Filters	Logs, Maps, Globes, Time Ind'rs.	Phonograph*: Automatic Record Chg'rs.	Phonograph*: Motor & Turntable Units	Phonograph*: Needles (Cutt. & Repro.)	Phonograph*: Records (Commercial)	Phonograph*: Recorders	Phonograph*: Recording Blanks	Phonograph*: Record Players	Power Supply Eqp't.: AC to DC Converters	Power Supply Eqp't.: DC to AC Inverters	Power Supply Eqp't.: Dynamotors	Tubes—(Electronic): Cathode-Ray	Tubes—(Electronic): Phototubes & Photocells	Tubes—(Electronic): Receiving	Tubes—(Electronic): Thyratron & Grid Glow	Tubes—(Electronic): Transmitting	Tuning Dials—Units: Cables & Belts	Tuning Dials—Units: Dials	Tuning Dials—Units: Escutcheons	Tuning Dials—Units: Push-Button Knobs	Tuning Dials—Units: P.B. Tuning Unit Assembly	Tuning Dials—Units: Station Name Cards	Tuning Motors	Miscellaneous
Tung-Sol Lamp Works, Inc., Radio Tube Div., 95 8th Ave., Newark, N. J.																									●										
Tungstone Needle Corp., 35 Santa Rosa Ave., Los Angeles, Cal.																●																			
"Uneed-it" (see Bright Star Battery Co.)																																			
Union Chest & Cabinet Corp., Rochester, N. Y.								●																											
United Carr Fastener Corp., 15 East 26th St., New York, N. Y.											●																								
United Electronics Co., 42 Spring St., Newark, N. J.																												●							
United Motors Service, Inc., Detroit, Mich.	●																																		
United Shoe Machinery Co., Waterbusy, Conn.											●																								
Universal Battery Co., (*"Universal"*), 3410 S. La Salle St., Chicago, Ill.		●																																	
Universal Microphone Co., Inglewood, Cal.										●						●		●	●																
"Usalite" (see U. S. Elec. Mfg. Corp.)																																			
U. S. Electric Mfg. Corp. (*"Usalite"*), 222 W. 14th St., New York, N.Y.		●																																	
U. S. L. Battery Corp. (*"U-S-L"*), Niagara Falls, N. Y.		●																																	
U. S. Metal Prod. Co., 128 Mott St., New York, N. Y.	●																																		
U. S. Record Corp., 1780 Broadway, New York, N. Y.																	●																		
Utah Radio Products Co., (*"Utah"*), 812 Orleans St., Chicago, Ill.																																	●		●	
Valley Elect. Corp., 4221 Forest Park Blvd., St. Louis, Mo.				●																															
Verti-Flex Div. Illinois Seating Corp., 2138 N. Racine Ave., Cleveland, Ohio	●																																		
Victor (RCA Mfg. Co.), Camden, N. J.																	●																		
Victory Mfg. Co., Inc., 2021 S. Michigan Ave., Chicago, Ill.	●																																		
Volta Battery Corp., 91 Williams Ave., Detroit, Mich.		●																																	
Wabash Cabinet Co., Wabash, Ind.								●																											
Ward Leonard Elect. Co., South Mt. Vernon, N. Y.				●																															
Ward Products Corp., 1523 E. 45th St., Cleveland, Ohio	●																																		
Warren Furniture Co., Warren, Pa.								●																											
Warren Telechron Co., 252 Main St., Ashland, Mass.									●																										
Watertown Mfg. Co., Echo Lake Rd., Watertown, Conn.																														●					
Watterson Radio Mfg. Co., Dallas, Texas								●																											
Weber-Costello Co., Chicago Heights, Chicago, Ill.													●																						
Webster-Chicago Corp., (*"Webster-Chicago"*), 5622 Bloomingdale Ave., Chicago, Ill.														●	●			●		●															
Webster Elect. Co., Racine, Wisc.																				●															
Wedge Mfg. Co., 2334 S. Michigan Ave., Chicago, Ill.	●		●																																
Western Electric Co., 195 Broadway, New York, N. Y.										●					●									●	●	●	●								
Westinghouse Electric & Mfg. Co., Lamp Div., Bloomfield, N. J.																									●		●	●							
Weston Electrical Instrument Corp., Frelinghuysen Ave., Newark, N. J.																									●										
White Wind Electric Co., 2300 E. Douglas Ave., Wichita, Kans.		●			●																														
Wilcox-Gay Corp., Charlotte, Mich.																		●	●																
Willard Storage Batt. Co., (*"Willard"*), 246 E. 131st St., Cleveland, Ohio		●																																	
Wincharger Corp., (*"Wincharger"*), Sioux City, Iowa		●			●																														
"Winchester" (see Bond Electric Corp.)																																			
Wind Gen-e-rotor, Des Moines, Iowa					●																														
Wind Impeller Electric Works, Ellsworth, Iowa		●			●																														
Worrick, F. C., & Co., Tulley, Mass.								●																											
Zenith Radio Corp., (*"Zenith"*), 6001 Dickens Ave., Chicago, Ill.	●	●																		●															
Zephyr Products Co., 67 W. 44th St., New York, N. Y.																		●																	
Zierick Mfg. Corp., 385 Gerard Ave., New York, N. Y.											●																								

*NOTE: For "Phonograph Pickups" manufacturers see the directory of SOUND AMPLIFIER EQ'PT. MNFR'S.

MANUFACTURERS	Cables	Coils: I-F	Coils: R-F	Coils: R-F Choke	Condensers: Air Trimmer	Condensers: Mica Trimmer	Condensers: Electrolytic	Condensers: Mica (Receiving)	Condensers: Paper	Condensers: Temp. Compensating	Condensers: Tuning (Receiver)	Insulation	Line Cords	Loudspeaker Parts, Replacements: Cones*	Loudspeaker Parts, Replacements: Field Coils*	Loudspeaker Parts, Replacements: Miscell. Accessories	Plugs	Remote Controls: Control Heads	Remote Controls: Flexible Shafts	Resistors: Adjustable	Resistors: Fixed	Resistors: Plug-in Ballast	Resistors: Suppressor (Auto Radio)	Sockets (Tube)	Switches: Band, Tap, Rotary	Switches: Circuit	Switches: Power	Transformers: Audio	Transformers: Power	Transformers: Exact Replacement	Vibrators	Vol. & Tone Controls	Wire		Miscellaneous
Acme Elec. & Mfg. Co., 31 Water St., Cuba, N. Y.												●																●	●						
Acme Wire Co., 1225 Dixwell Ave., New Haven, Conn.																																		
Acorn Insulated Wire Co., Inc., 225 King St., Brooklyn, N. Y.	●																															●		
Aerovox Corp., New Bedford, Mass.							●	●	●	●										●	●													
Aladdin Radio Industries, Inc., 466 W. Superior St., Chicago, Ill.		●	●			●●																												
Alden Products Co., 715 Center St., Brockton, Mass.	●		●			●					●	●					●							●	●	●						●		
Allen-Bradley Co., 1326 S. Second St., Milwaukee, Wisc.																				●	●		●	●							●	●		
Alpha Wire Corp., 50 Howard St., New York, N. Y.	●												●																			●		
American Condenser Winding Corp., 4824 W. Van Buren St., Chicago, Ill.							●		●																									
American Cond. Corp., 2508 S. Michigan Ave., Chicago, Ill.							●																											
American Elec. Cable Co., Holyoke, Mass.																																●●		
American Enameled Magnet Wire Co., Port Huron, Mich.																																		
American Lava Corp., Chattanooga, Tenn.												●																						
American Metal Stamping Corp., 62 No. 9th St., Bridgeport, Conn.																								●										
American Mica Works Corp., 47 West St., New York, N. Y.												●●																						
American Phenolic Corp., 1250 W. Van Buren St., Chicago, Ill.	●											●					●							●●	●●	●								
American Radio Hardware Co., 476 Broadway, New York, N. Y.																	●							●●	●●	●●								
American Steel Package Co., Defiance, Ohio											●																							
American Steel & Wire Co., Rockefeller Bldg., Cleveland, Ohio	●																															●		
American Television & Radio, 300 E. 4th St., St. Paul, Minn.																															●			
American Transformer Co., 178 Emmet St., Newark, N. J.																												●	●					
Amperite Co., 561 Broadway, New York, N. Y.																					●	●												
Amphion Mfg. Co., 123 Liberty St., New York, N. Y.														●																				
Anaconda Wire & Cable Co., 25 Broadway, New York, N. Y.	●																															●		
Arlab Mfg. Co., 1250 N. Paulina St., Chicago, Ill.																												●	●					
Atkins & Brown, 215—14th St., Oakland, Cal.											●																							
Atlas Condenser Prod. Co., 548 Westchester Ave., New York, N. Y.							●		●																									
Atlas Resistor Co., 423 Broome St., New York, N. Y.																				●	●													
Atlas Sound Corp., 1451—39th St., Brooklyn, N. Y.																	●																	
Audio Development Co., 123 Bryant Ave., North, Minneapolis, Minn.																												●●	●					
Audio Research Products Corp., 921 Grand Ave., Detroit, Mich.																												●						
Automatic Winding Co., 900 Passaic Ave., Newark, N. J.		●	●	●	●	●					●																							
Bakelite Corp., 30 E. 42nd St., New York, N. Y.												●																						
Barber & Howard Inc., Westerly, Rhode Island		●	●	●																														
Barker & Williamson, Ardmore, Pa.				●																					●	●								
Bastian Bros. Co., 1600 N. Clinton Ave., Rochester, N. Y.																								●										
Belden Mfg. Co., 4647 W. Van Buren St., Chicago, Ill.	●												●																					
Best Mfg. Co., 1200 Grove St., Irvington, N. J.																									●	●						●		
Birnbach Radio Co., 145 Hudson St., New York, N. Y.	●											●	●				●							●								●		
Bond Radio Co., 13139 Hamilton Ave., Detroit, Mich.		●	●	●					●																									
Boonton Molding Co., Boonton, N. J.												●																							
Boston Insul. Wire & Cable Co., Dorchester, Mass.	●												●																			●		
Brach, L. S., Mfg. Corp., 55 Dickerson St., Newark, N. J.	●																																	
Brand, W., & Co., 268 Fourth Ave., New York, N. Y.												●																						
Brandywine Fibre Prod., Wilmington Delaware												●																						
Browning Labs., Inc., Winchester, Mass.		●	●	●																														
Bud Radio Inc., 5205 Cedar Ave., Cleveland, Ohio		●●	●●	●●	●	●					●						●							●	●	●	●							
Burlington Labs., Inc., 1617 N. Damen Ave., Chicago, Ill.		●	●	●																														
Cable Mfg. Corp., 419—4th Ave., New York, N. Y.	●																																	
Cannon Elec. Devel. Co., 3209 Humboldt St., Los Angeles, Cal.																	●							●										
Carbon Products Corp., 222 Grant Ave., Pittsburgh, Pa.																					●													

*See Note at bottom of page 709

—(Continued)

*NOTE: For "Loudspeaker," "Horn," & "Baffle" manufacturers see the directory of SOUND AMPLIFIER EQ'PT. MNFR'S.

MANUFACTURERS	Cables	Coils: I-F	Coils: R-F	Coils: R-F Choke	Condensers: Air Trimmer	Condensers: Mica Trimmer	Condensers: Electrolytic	Condensers: Mica (Receiving)	Condensers: Paper	Condensers: Temp. Compensating	Condensers: Tuning (Receiver)	Insulation	Line Cords	Loudspeaker Parts, Replacements: Cones*	Loudspeaker Parts, Replacements: Field Coils*	Loudspeaker Parts, Replacements: Miscell. Accessories	Plugs	Remote Controls: Control Heads	Remote Controls: Flexible Shafts	Resistors: Adjustable	Resistors: Fixed	Resistors: Plug-in Ballast	Resistors: Suppressor (Auto Radio)	Sockets (Tube)	Switches: Band, Tap, Rotary	Switches: Circuit	Switches: Power	Transformers: Audio	Transformers: Power	Transformers: Exact Replacement	Vibrators	Vol. & Tone Controls	Wire		Miscellaneous
Carborundum Co. (Globar Division), Niagara Falls, N. Y.																																		
Cardwell Mfg. Co., 81 Prospect St., Brooklyn, N. Y.					●						●										●		●											
Carling Tool & Machine Co., 626 Capitol Ave., Hartford, Conn.																										●								
Carron Mfg. Co., 415 S. Aberdeen St., Chicago, Ill.		●	●	●	●	●	●				●			●	●	●								●	●	●								
Centralab, 900 E. Keefe Ave., Milwaukee, Wisc.						●				●										●	●		●	●	●	●					●			
Champion Radio Works, Danvers, Mass.																						●												
Chicago Teleph. Supply Co., Elkhart, Ind.																	●																	
Chicago Transformer Corp., 3501 W. Addison St., Chicago, Ill.																											●	●			●			
Cinch Mfg. Corp., 2335 W. Van Buren St., Chicago, Ill.																	●							●										
Clarostat Mfg. Co., 285 N. 6th St., Brooklyn, N. Y.													●							●	●	●			●	●					●			
Coils, Inc., Providence, R. I.		●	●	●																														
Coil Winding Corp. of America, 132 Lowell Ave., Springfield, Mass.		●	●																															
Collins Radio Co., 2920 First Ave., Cedar Rapids, Iowa																											●	●						
Condenser Corp. of America, S. Plainfield, N. J.							●		●																									
Condenser Products Co., 1369 N. Branch St., Chicago, Ill.							●		●																									
Consolidated Wire & Assoc. Corps., 1635 S. Clinton St., Chicago, Ill.	●	●	●	●			●		●				●										●								●			
Copperwald Steel Co., Glassport, Pa.																															●			
Continental Carbon, Inc., 13900 Lorain Ave., Cleveland, Ohio									●												●		●											
Continental-Diamond Fibre Co., Newark, Delaware												●																						
Continental Elec. Co., Geneva, Ill.																											●							
Cornell-Dubilier Elec. Corp., 1003 Hamilton Blvd., S. Plainfield, N. J.							●	●	●	●																								
Cornish Wire Co., 15 Park Row, New York, N. Y.	●												●																			●		
Cosmic Radio Corp., 699 E. 135th St., New York, N. Y.							●		●																							●		
Crescent Insulated Wire & Cable Co., Trenton, N. J.	●																															●		
Crowe Name Plate Mfg. Co., 3701 Ravenswood Ave., Chicago, Ill.																		●	●															
Crowley, H. L., & Co., Inc., 1 Central Ave., W. Orange, N. J.												●																						
Curtis Condenser Corp., 3088 W. 106th St., Cleveland, Ohio							●		●																									
Cutler-Hammer Mfg. Co., Milwaukee, Wisc.																										●								
Dano Elec. Co., 93 Main St., Winsted, Conn.																																		
Daven Co., 158 Summit St., Newark, N. J.																				●	●							●	●		●			
De Jur-Amsco Corp., Shelton, Conn.						●					●																							
Delco Appl. Div. Gen. Motors Sales Corp., 391 Lyell Ave., Rochester, N. Y.																														●				
Deutschmann, Tobe, Corp., Canton, Mass.							●		●																									
Diamond Cable & Wire Co., Chicago Heights, Ill.	●												●																			●		
Dongan Elect. Mfg. Co., 2987 Franklin St., Detroit, Mich.																												●	●					
Dual Remote Control Co., 31776 W. Warren Ave., Wayne, Mich.																		●	●															
Dumont Electric Co., Inc., 514 Broadway, New York, N. Y.							●	●	●	●																								
Eby, Hugh H., Inc., 4700 Stenton Ave., Philadelphia, Pa.																	●							●	●	●								
Electricoil Co., Inc., 6 Varick St., New York, N. Y.		●	●																									●	●					
Electronic Laboratories, 122 W. New York St., Indianapolis, Ind.																															●			
Erie Resistor Corp. ("Erie"), 644 W. 12th St., Erie, Pa.						●			●	●											●		●											
Essex Wire Corp., 14310 Woodward Ave., Detroit, Mich.	●																															●		
Faradon Condenser Winding Corp., 621 Belmont Ave., Chicago, Ill.									●																									
Farrand, Henry, Elec. Co., 32 Cabot Ave., New Haven, Conn.																																		
Fast, John E., & Co., 3115 N. Pulaski Rd., Chicago, Ill.									●									●																
Ferranti Elec. Inc., 30 Rockefeller Plaza, New York, N. Y.																												●	●					
Ferrocart Corp., Hastings-on-Hudson, N. Y.		●	●	●																														
Filtermatic Mfg. Co., 6913 Ditman St., Philadelphia, Pa.								●																										

—(Continued)

*NOTE: For "Loudspeaker," "Horn," & "Baffle" manufacturers see the directory of SOUND AMPLIFIER EQ'PT. MNFR'S.

MANUFACTURERS	Cables	Coils: I-F	Coils: R-F	Coils: R-F Choke	Condensers: Air Trimmer	Condensers: Mica Trimmer	Condensers: Electrolytic	Condensers: Mica (Receiving)	Condensers: Paper	Condensers: Temp. Compensating	Condensers: Tuning (Receiver)	Insulation	Line Cords	Loudspeaker Parts, Replacements: Cones*	Loudspeaker Parts, Replacements: Field Coils*	Loudspeaker Parts, Replacements: Miscell. Accessories	Plugs	Remote Controls: Control Heads	Remote Controls: Flexible Shafts	Resistors: Adjustable	Resistors: Fixed	Resistors: Plug-in Ballast	Resistors: Suppressor (Auto Radio)	Sockets (Tube)	Switches: Band, Tap, Rotary	Switches: Circuit	Switches: Power	Transformers: Audio	Transformers: Power	Transformers: Exact Replacement	Vibrators	Vol. & Tone Controls	Wire		Miscellaneous
Franklin, A. W., Mfg. Corp., 175 Varick St., New York, N. Y.																	●							●	●	●		●	●	●					
Freed Transformer Co., 72 Spring St., New York, N. Y.																																			
Galvin Mfg. Corp., 4545 Augusta Blvd., Chicago, Ill.																																			
Gaylord Mfg. Co., 605 W. Washington St., Chicago, Ill.									●																					●				
General Cable Corp., 420 Lexington Ave., New York, N. Y.	●																															●		
General Cement Mfg. Co., Rockford, Ill.												●																						
General Electric Co., Bridgeport, Conn.														●	●	●						●												
General Electric Co., Schenectady, New York												●															●	●	●			●		
General Insulated Wire Corp., Providence, R. I.	●																																	
General Instrument Corp., 829 Newark Ave., Elizabeth, N. J.											●																							
General Mfg. Co., 8066 S. Chicago Ave., Chicago, Ill.		●	●																															
General Plastics Inc., N. Tonawanda, N. Y.												●																						
General Radio Co., 30 State St., Cambridge, Mass.									●		●						●				●			●	●	●	●	●						
General Socket Corp., 623 River Ave., Worcester, Mass.																								●										
General Transformer Corp., 1250 W. Van Buren St., Chicago, Ill.																												●	●	●				
General Winding Co., (*"Gen-Win"*), 254 W. 31st St., New York, N. Y.		●	●	●	●	●																												
Girard Continental Con. Corp., 2341 Wolfram St., Chicago, Ill.									●																									
Girard Hopkins, 1437—23rd Ave., Oakland, Cal.							●		●												●													
Globar Corp., Niagara Falls, N. Y.																					●		●											
Gordon Specialties Co., 1104 S. Wabash Ave., Chicago, Ill.																										●								
Greyhound Equipt. Co., 1720 Church Ave., Brooklyn, N. Y.		●	●	●																														
Guardian Elec. Mfg. Co., 1621 W. Walnut, Chicago, Ill.																	●									●								
Guthman, Edwin I., & Co., Inc., 400 S. Peoria St., Chicago, Ill.		●	●			●					●																							
Hackensack Cable Co., Hackensack, N. J.	●																																	
Haldorson Co., 4500 Ravenswood Ave., Chicago, Ill.																																		
Hammarlund Mfg. Co., Inc., 424 W. 33rd St., New York, N. Y.		●	●	●	●	●					●													●				●	●				
Hardwick-Hindle, 40 Herman St., Newark, N. J.																				●	●													
Hart-Hegeman, Hartford, Conn.																										●								
Hawley Products Co., 201 N. First Ave., St. Charles, Ill.																																		
Holyoke Co., Inc., 720 Main St., Holyoke, Mass.	●												●	●																		●		
Hudson Wire Co., Winsted Div., 981 Main St., Winsted, Conn.																																●		
Hygrade Sylvania Corp., Emporium, Pa. (*now Sylvania Elec. Prod. Inc.*)																						●												
Hytron Corp., 76 Lafayette St., Salem, Mass.																						●												
Illinois Condenser Co., 3252 W. North Ave., Chicago, Ill.							●																											
Inca Mfg. Co., Ft. Wayne, Ind.																													●	●				
Instrument Resistors Inc., Little Falls, N. J.																					●													
Insulation Mfg. Corp., 565 W. Washington Blvd., Chicago, Ill.												●																						
Insuline Corp. of America, 30-30 Northern Blvd., Long Island City, N.Y.		●	●	●	●	●					●						●					●		●	●	●	●						
International Resistance Co., 401 N. Broad St., Philadelphia, Pa.																				●	●		●							●				
Isolantite, Inc., 233 Broadway, New York, N. Y.												●												●	●	●								
James Vibrapowr Co., 341 N. Crawford Ave., Chicago, Ill.																															●			
J. B. L. Instrument Co., Darby, Pa.																																		
J. F. D. Mfg. Co., 4109 Ft. Hamilton Parkway, Brooklyn, N. Y.													●					●					●	●										
Jefferson Elec. Co., Bellwood, Ill.																		●										●	●					
Johnson, E. F., Co., Waseca, Minn.			●																															
Jones, H. B., 2300 Wabansia Ave., Chicago, Ill.																	●	●						●										
Kellogg Switchboard & Supply Co., 6650 S. Cicero Ave., Chicago, Ill.																								●				●						
Kenyon Transformer Co., 840 Barry St., New York, N. Y.									●																			●	●					

—(Continued)

*NOTE: For "Loudspeaker," "Horn," & "Baffle" manufacturers see the directory of SOUND AMPLIFIER EQ'PT. MNFR'S.

MANUFACTURERS	Cables	Coils: I-F	Coils: R-F	Coils: R-F Choke	Condensers: Air Trimmer	Condensers: Mica Trimmer	Condensers: Electrolytic	Condensers: Mica (Receiving)	Condensers: Paper	Condensers: Temp. Compensating	Condensers: Tuning (Receiver)	Insulation	Line Cords	Loudspeaker Parts, Replacements: Cones*	Loudspeaker Parts, Replacements: Field Coils*	Loudspeaker Parts, Replacements: Miscell. Accessories	Plugs	Remote Controls: Control Heads	Remote Controls: Flexible Shafts	Resistors: Adjustable	Resistors: Fixed	Resistors: Plug-in Ballast	Resistors: Suppressor (Auto Radio)	Sockets (Tube)	Switches: Band, Tap, Rotary	Switches: Circuit	Switches: Power	Transformers: Audio	Transformers: Power	Transformers: Exact Replacement	Vibrators	Vol. & Tone Controls	Wire		Miscellaneous
Lafayette Mfg. Corp., Peoria, Ill.																	●																	
Lenz Elec. Mfg. Co., 1751 N. Western Ave., Chicago, Ill.	●																																	
Leotone Radio Co., 63 Dey St., New York, N. Y.														●	●	●																		
Link, Fred M., 125 W. 17th St., New York, N. Y.			●																															
Lowell Insulated Wire Co., 171 Lincoln St., Lowell, Mass.	●																															●		
Magnavox Co., 2131 Beuter Rd., Fort Wayne, Ind.							●																											
Magnetic Windings Co., 16th St. & Butler, Easton, Pa.						●	●		●	●							●			●	●		●	●	●	●	●	●		●				
Mallory, P. R., & Co. Inc., Indianapolis, Ind.			●		●	●	●		●		●	●					●																	
Meissner Mfg. Co., Mt. Carmel, Ill.								●				●									●													
Mica Insulator Co., 200 Varick St., New York, N. Y.									●													●												
Micamold Radio Corp., 1087 Flushing Ave., Brooklyn, N. Y.												●																						
Micarta Fabricators, Inc., 4619 Ravenswood Ave., Chicago, Ill.																																		
Micro Switch Corp., 1 East Spring, Freeport, Ill.																																		
Midget Switch Devices Co., 92 Commons Ave., Boston, Mass.																																		
Millen, James, Mfg. Co., Malden, Mass.																																		
Miller, J. W., Co., 5917 S. Main St., Los Angeles, Cal.																																		
Mitchell-Rand Co., 51 Murray St., New York N. Y.																																		
Morrill & Morrill, 30 Church St., New York, N. Y.																																		
Multiplex Products Co., 201 N. First Ave., St Charles, Ill.																																		
Muter Co., 1255 S. Michigan Ave., Chicago, Ill.																																		
Mycalex Corp. of America, 7 E. 42nd St., New York, N. Y.																																		
National Co., 61 Sherman St., Malden, Mass.																																		
National Elec. Controller Co., 5309 Ravenswood Ave., Chicago, Ill.																																		
National Union Radio Corp., 57 State St., Newark, N. J.																																		
National Vulcanized Fibre Co., Wilmington, Delaware																																		
Oak Mfg. Co., 711 W. Lake St., Chicago, Ill.																																		
Ohio Carbon Co., 12508 Berea Rd., Lakewood, Ohio																																		
Ohmite Mfg. Co., 4835 Flournoy St., Chicago, Ill.																																		
Pearson Products Corp., 132 Walnut St., Philadelphia, Pa.																																		
Phelps Dodge Corp. (*"Inca"*), Fort Wayne, Ind.																																		
Philadelphia Wire & Cable Corp., 926 Sequoia Ave., Philadelphia, Pa.																																		
Philco Radio & Telev. Corp., Tioga & C Sts., Philadelphia, Pa.																																		
Potter, The, Co., 1950 Sheridan Rd., N. Chicago, Ill.																																		
Precision Coil Corp., 123 Delafield Ave., Stamford, Conn.																																		
Precision Resistor Co., 334 Badger Ave., Newark, N. J.																																		
Precision Wire Products Corp., 325 Grand Ave., Chicago, Ill.																																		
Radiart Corp., W. 62nd St. & Barberton Ave., Cleveland, Ohio																																		
Radio City Products Co., 88 Park Place, New York, N. Y.																																		
Radio Condenser Co., Camden, N. J.																																		
Raytheon Production Corp., 420 Lexington Ave., New York, N. Y.																																		
Radio Corp. of America, RCA Victor Division, Camden, N. J.																																		
Readrite Meter Works, Bluffton, Ohio																																		
Reliance Die & Stamping Co., 1260 Clybourn Ave., Chicago, Ill.																																		
Remler Co. Ltd., 2101 Bryant St., San Francisco, Cal.																																		
Resinox Corp., 30 Rockefeller Plaza, New York, N. Y.																																		
Rockbestos Products Corp., 751 Nicoll, New Haven, Conn.																																		

—(Continued)

*NOTE: For "Loudspeaker," "Horn," & "Baffle" manufacturers see the directory of SOUND AMPLIFIER EQ'PT. MNFR'S.

MANUFACTURERS	Cables	Coils: I-F	Coils: R-F	Coils: R-F Choke	Condensers: Air Trimmer	Condensers: Mica Trimmer	Condensers: Electrolytic	Condensers: Mica (Receiving)	Condensers: Paper	Condensers: Temp. Compensating	Condensers: Tuning (Receiver)	Insulation	Line Cords	Loudspeaker Parts, Replacements: Cones*	Loudspeaker Parts, Replacements: Field Coils*	Loudspeaker Parts, Replacements: Miscell. Accessories	Plugs	Remote Controls: Control Heads	Remote Controls: Flexible Shafts	Resistors: Adjustable	Resistors: Fixed	Resistors: Plug-in Ballast	Resistors: Suppressor (Auto Radio)	Sockets (Tube)	Switches: Band, Tap, Rotary	Switches: Circuit	Switches: Power	Transformers: Audio	Transformers: Power	Transformers: Exact Replacement	Vibrators	Vol. & Tone Controls	Wire		Miscellaneous
Sangamo Elect. Co., 1301 N. 11th St., Springfield, Ill.								●																										
Scovill Mfg. Co., 90 Mill St., Waterbury, Conn.											●																						
Selectar Mfg. Corp., 30 West 15th St., New York, N. Y. (formerly "Bruno Labs.")																	●																
Sevison Magneto Engineering Co., 379 Phillips Ave., Toledo, Ohio									●																								
Shallcross Mfg. Co., 10 Jackson Ave., Collingdale, Pa.																					●												
Sickles, F. W., Co., 300 Main St., Springfield, Mass.		●	●		●	●																											
Simplex Wire & Cable Co., Cambridge, Mass.	●																																
Sola Elect. Co., 2525 Clyburn Ave., Chicago, Ill.																											●	●					
Solar Mfg. Corp., 586 Ave. A., Bayonne, N. J.						●	●	●	●	●																							
Spaulding Fibre Co., Inc., Tonawanda, N. Y.												●																					
Speer Carbon Co., Theresia St., St. Marys, Pa.																					●	●		●									
Sprague Products Co., North Adams, Mass.							●	●	●	●											●	●											
Stackpole Carbon & Control Co., Tannery St., St. Marys, Pa.																					●	●		●							●		
Standard Transformer Corp., 1500 N. Halstead St., Chicago, Ill.																											●	●	●				
Star Machine Works, Inc., 1371 E. Bay Ave., New York, N. Y.																		●	●														
Steward, D. M., Mfg. Co., Chattanooga, Tenn.												●																					
Stewart, F. W., Mfg. Corp., 340 W. Huron St., Chicago, Ill.																		●	●														
Stromberg-Carlson Tel. Mfg. Co., 100 Carlson Rd., Rochester, N. Y.									●																								
Struthers-Dunn, Inc., 1321 Cherry St., Philadelphia, Pa.																										●							
Synthane Corp., Highland Ave., Oaks, Pa.												●																					
Tech Laboratories, 7 Lincoln St., Jersey City, N. J.																															●		
Teleradio Engineering Corp. ("*Teleradio*"), 490 Broome St., N. Y. C.		●	●	●	●	●				●																							
Thordarson Elec. Mfg. Co., 500 W. Huron St., Chicago, Ill.																											●	●					
Tilton Elec. Corp., 15 E. 26th St., New York, N. Y.							●		●																								
Tindall Fabrics Corp., 486 Pawtucket Ave., Pawtucket, R. I.																●																	
Titchener, E. H., & Co., Walnut St., Binghamton, N. Y.																															●		
Todd Products Co., 179 Wooster St., New York, N. Y.																											●	●					
Triad Mfg. Co., Inc., Pawtucket, R. I.																							●										
Triplett Elec. Inst. Co., Bluffton, Ohio																									●	●							
Trumbull Elec. Mfg. Co., Plainville, Conn.																											●						
Tung-Sol Lamp Works, Inc., 95 Eighth Ave., Newark, N. J.																							●										
Turner, The, Co., Cedar Rapids, Iowa																														●			
United Pressed Products Co., 407 S. Aberdeen, Chicago, Ill.														●	●																		
United Transformer Corp., 150 Varick St., New York, N. Y.																											●	●					
U. S. Rubber Products Co., 1230 Sixth Ave., New York, N. Y.	●																																
Utah Radio Products Co., 812 Orleans St., Chicago, Ill.																					●	●					●			●	●		
Victory Mfg. Co., Inc., 2021 S. Michigan Ave., Chicago, Ill.																			●														
Ward Leonard Elec. Co., South Mt. Vernon, N. Y.																					●	●											
Ward Products Corp., 1523 E. 45th St., Cleveland, Ohio																								●									
Western Electric Co., 195 Broadway, New York, N. Y.	●																														●		
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.												●																					
Weston Elec. Inst. Corp., Frelinghuysen Ave., Newark, N. J.																									●	●							
White, S. S., Dental Mfg. Co., (Ind. Div.), 10 E. 40th St., N. Y. C.																			●			●											
Wiegand, Edwin L., Co., 7530 Thomas Blvd., Pittsburgh, Pa.												●																					
Wirt Co., 5221 Greene St., Philadelphia, Pa.																					●	●	●			●	●				●		
Yaxley Div. of P. R. Mallory & Co., Inc., 3029 E. Wash., Indianap., Ind.						●	●		●	●							●				●	●	●	●	●	●	●				●		
Zenith Radio Corp., 6001 Dickens Ave., Chicago, Ill.																					●	●	●	●	●	●							
Zophar Mills Inc., 116—26th St., Brooklyn, N. Y.												●											●										

*NOTE: For "Loudspeaker," "Horn," & "Baffle" manufacturers see the directory of SOUND AMPLIFIER EQ'PT. MNFR'S.

CLASSIFIED DIRECTORY OF SOUND AMPLIFIER EQUPMENT MANUFACTURERS*

MANUFACTURERS	Complete System*				Intercommunications	Loud-speakers†				Microphones								Phonograph Pickups‡				Miscellaneous
	Fixed	Mobile	Portable	With Film Projector		Dynamic	Magnetic	P.M. Dynamic	Horns & Baffles	Carbon	Condenser	Contact	Crystal	Dynamic	Inductor	Velocity	Fittings & Access.	Crystal	Dynamic	Magnetic	Photoelectric	
Acme Sound Co., 251 W. 55th St., New York, N. Y.	●	●	●		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	
Adams Labs. Inc., 56 W. 22nd St., New York, N. Y.					●																	
Allied Radio Corp., 833 W. Jackson Blvd., Chicago, Ill.	●	●	●		●					●				●								
American Microphone Co., 1915 S. Western Ave., Los Angeles, Cal.											●					●	●					
American Phenolic Corp., 1250 W. Van Buren St., Chicago, Ill.	●				●								●	●		●	●					
American Transformer Co., 178 Emmet St., Newark, N. J.											●											
Amperite Co., 561 Broadway, New York, N. Y.												●				●						
Amplifier Co. of America, 17 W. 20th St., New York, N. Y.	●	●	●		●																	
Ampro Corp., 2839 N. Western Ave., Chicago, Ill.				●																		
Astatic Microphone Lab., Inc., 830 Market St., Youngstown, Ohio													●				●					
Atlas Sound Corp., 1451—39th St., Brooklyn, N. Y.		●			●	●		●	●								●			●		
Audak Co., 500 Fifth Ave., New York, N. Y.																						
Audio Development Co., 123 Bryant Ave., North Minneapolis, Minn.	●		●																			
Audio Devices, Inc., 1600 Broadway, New York, N. Y.	●		●																			
Audiograph Sound Systems, 1313 W. Randolph St., Chicago, Ill.	●	●	●																			
Autocrat Radio Co., 3885 N. Hamilton Ave., Chicago, Ill.	●		●		●																	
Automatic Musical Inst. Co., 1600 Union Ave. S.E., Grand Rapids, Mich.																						
Bell & Howell Co., 30 Rockefeller Plaza, New York, N. Y.			●																			
Bell Sound Systems, Inc., 61-62 E. Goodale St., Columbus, Ohio	●	●	●		●				●													
Bendix Radio Mfg. Co., Wood Lake, Minn.																	●					
Berndt-Maurer Corp., 117 East 24th St., New York, N. Y.			●			●	●	●	●													
Best Mfg. Co., 1200 Grove St., Irvington, N. J.					●																	
Bogen, David, Co., Inc., 663 Broadway, New York, N. Y.	●	●	●		●	●	●	●	●													
Bondette & Co., Chelsea, Mass.																						
Brown Ehinger Radio Co., 3924 Wash. Blvd., St. Louis, Mo.	●	●	●		●	●	●	●														
Bruno Labs., Inc., 30 W. 15th St., New York, N. Y.																						
now Selectar Mfg. Corp.)																						
Brush Development Co., 3317 Perkins Ave., Cleveland, Ohio																						
Bud Radio, Inc., 5205 Cedar Ave., Cleveland, Ohio										●												
Cannon Electric Devel. Co., 3209 Humboldt St., Los Angeles, Cal.																						
Cannon, C. F., Co., Springwater, N. Y.							●															
Carrier Microphone Corp., 439 S. La Brea Ave., Inglewood, Cal.														●		●			●			
Carron Mfg. Co., 415 S. Aberdeen St., Chicago, Ill.																						
hicago Sound Systems Co., 160 E. Illinois St., Chicago, Ill.					●																	
Chnaudagraph Speakers Inc., 3911-3929 S. Michigan Ave., Chicago, Ill. —						●		●	●													
Collins Radio Co., 2920 First Ave., Cedar Rapids, Iowa	●	●	●			●																
Columbia Sound Systems Inc., 982 Essex Ave., Columbus, Ohio	●	●	●			●																
Consolidated Sound Corp., 1215 Fidelity Bldg., Chicago, Ill.	●	●	●			●		●														
Continental Motors Corp., 12801 E. Jefferson St., Detroit, Mich.																						
Continental Music Co. Inc., 630 S. Wabash Ave., Chicago, Ill.			●							●												
Couch, S. H., Co., Inc., North Quincy, Mass.																						
Deluxe Sound Corp., 2510 Perkins Ave., Cleveland, Ohio	●		●			●				●												
De Vry Corp., 52 Vanderbilt Ave., New York, N. Y.				●																		
Dictograph Products Co., Inc., 580 Fifth Ave., New York, N. Y.					●																	
Dunn-Hall Co., 1477 W. Adams St., Los Angeles, Cal.																						
Eastman Kodak Co., Rochester, N. Y.	●	●	●	●																		
Electra Corp., 1500 N. Kostner Ave., Chicago, Ill.																						
Electro Acoustic Pd'ts. Co., 213 Beuter Road, Ft. Wayne, Ind.	●	●	●		●																	
Electronic Design Corp., 144 N. May St., Chicago, Ill.	●	●	●																			
Electro-Voice Mfg. Co., 1239 South Bend Ave., South Bend, Ind.					●				●													
Emco Radio Products, 78 Reade St., New York, N. Y.																						
Empire Sound Equipt. Corp., 721 Broadway, New York, N. Y.	●		●																			

*NOTE: For "Power Supply Eq'pt." and "Battery Chargers" see the directory of ACCESSORIES MNFR'S.

†NOTE: For Loudspeaker "Cones," "Field Coils" & "Accessories" see the directory of PARTS MNFR'S.

‡NOTE: For "Phono Motors," "Record Changers," "Needles," "Blanks," etc., see the directory of ACCESSORIES MNFR'S.

*See Note at bottom of page 709

—(Continued)

SOUND AMPLIFIER EQP'T. MNFR'S.—(Cont'd)

MANUFACTURERS	Complete System*				Intercommunications	Loud-speakers†				Microphones								Phonograph Pickups‡				Miscellaneous
	Fixed	Mobile	Portable	With Film Projector		Dynamic	Magnetic	P.M. Dynamic	Horns & Baffles	Carbon	Condenser	Contact	Crystal	Dynamic	Inductor	Velocity	Fittings & Access.	Crystal	Dynamic	Magnetic	Photoelectric	
Erwood Sound Equipt. Co., 223 W. Erie St., Chicago, Ill.	●	●	●																			
Executone, Inc., 415 Lexington Ave., New York, N. Y.					●																	
Fairchild Aerial Camera Corp., 88-06 Van Wyck Blvd., Jamaica, N. Y.	●	●																				
Fox Sound Equipment Corp., 3220 Monroe St., Toledo, Ohio	●	●	●		●	●		●	●													
Garrard Sales Corp., 296 Broadway, New York, N. Y.																		●		●		
Gates Radio & Supply Co., Hampshire St., Quincy, Ill.	●																					
Gibbs, Thomas B., 900 W. Lake St., Chicago, Ill.	●	●	●		●				●													
Halldorson Co., 4500 Ravenswood Ave., Chicago, Ill. (*Amplifiers only*)	●																					
Hetro Electrical Industries, Inc., Chicago, Ill.		●																				
Holtzer-Cabot Elec. Co., 125 Amory St., Boston, Mass.					●																	
Insuline Corp. of America, 30-30 Northern Blvd., Long Island City, N.Y.										●												
International Business Mach. Corp., 590 Madison Ave., New York, N. Y.	●				●																	
Jefferson Elec. Co., Bellwood, Ill. (*Amplifiers only*)	●																					
Jensen Radio Mfg. Co., 6601 S. Laramie Ave., Chicago, Ill.						●		●	●													
Jones, Howard B., 2300 Wabansia Ave., Chicago, Ill.																	●					
Kainer & Co., 763 W. Lexington St., Chicago, Ill.									●													
Lafayette Radio Corp., 100 Sixth Ave., New York, N. Y.	●	●	●		●																	
Lansing Mfg. Co., 6900 McKinley Ave., Los Angeles, Cal.						●			●													
Leotone Radio Co., 63 Dey St., New York, N. Y.									●													
Lifetime Corp., 1825 Adams St., Toledo, Ohio	●	●	●		●			●	●	●	●			●		●						
Link, Fred. M., 125 W. 17th St., New York, N. Y.	●	●	●						●													
Magnavox Co., 2131 Beuter Road, Fort Wayne, Ind.						●			●													
Meck, John, Industries, Liberty & Penn. Aves., Plymouth, Ind.	●	●	●		●				●													
Melaphone Corp., Rochester, N. Y.	●		●						●													
Meyerson, L. A., Co., 570 Westminster Road, Brooklyn, N. Y.	●		●						●													
Miles Reproducer Co., 812 Broadway, New York, N. Y.	●	●	●		●				●	●	●			●								
Million Radio & Television, 1617 North Damen Ave., Chicago, Ill.	●				●				●													
Montgomery Ward & Co., Chicago, Ill.	●	●	●																			
Morlen Electric Co., Inc., 60 W. 15th St., New York, N. Y.	●	●	●		●																	
Operadio Mfg. Co., St. Charles, Ill.	●	●	●		●	●		●	●				●	●		●						
Ottawa Radio Co., 318 W. Lafayette St., Ottawa, Ill.	●		●																			
Oxford-Tartak Radio Corp., 915 W. Van Buren St., Chicago, Ill.						●	●	●	●													
Pacent Eng. Corp., 79 Madison Ave., New York, N. Y.	●	●																		●		
Permoflux, 4916 Grand Ave., Chicago, Ill.								●														
Philco Radio & Telev. Co., Tioga & C Sts., Philadelphia, Pa.		●	●		●	●		●													●	
Philmore Mfg. Co., Inc., 113 University Place, New York, N. Y.										●												
Pictur-Fone Co., Lima, Ohio	●		●		●																	
Public-Ad, Inc., 2015 E. 65th St., Cleveland, Ohio	●	●	●																			
Quam-Nichols Co., Cottage Grove Ave. & 33rd Place, Chicago, Ill.						●	●	●														
Racon Elec. Co., Inc., 52 E. 19th St., New York, N. Y.						●		●	●													
Radio Amplifier Labs., Inc., 31 Wooster St., New York, N. Y.	●	●	●																			
Radio Receptor Co., 251 W. 19th St., New York, N. Y.	●	●	●		●				●													

*NOTE: For "Power Supply Eq'pt." and "Battery Chargers" see the directory of ACCESSORIES MNFR'S.

†NOTE: For Loudspeaker "Cones," "Field Coils" & "Accessories" see the directory of PARTS MNFR'S.

‡NOTE: For "Phono Motors," "Record Changers," "Needles," "Blanks," etc., see the directory of ACCESSORIES MNFR'S

—(Continued)

MANUFACTURERS	Complete System*				Intercommunications	Loud-speakers†				Microphones								Phonograph Pickups‡				Miscellaneous
	Fixed	Mobile	Portable	With Film Projector		Dynamic	Magnetic	P.M. Dynamic	Horns & Baffles	Carbon	Condenser	Contact	Crystal	Dynamic	Inductor	Velocity	Fittings & Access.	Crystal	Dynamic	Magnetic	Photoelectric	
Radio Speakers, Inc., 221 E. Cullerton St., Chicago, Ill.						●	●	●														
Radiotone Recording Co., 7356 Melrose Ave., Hollywood, Cal.	●		●																			
Radio Wire Television, Inc., (See Lafayette Corp.)																						
Radolek Co., 601 W. Randolph St., Chicago, Ill.	●	●	●		●																	
Rauland Corp., 3341 Belmont Ave., Ch'go, Ill. (*now Webster-Rauland*)																						
Radio Corp. of America, RCA Victor Division, Camden, N. J.	●	●	●	●	●	●		●	●	●	●	●		●	●	●	●	●		●		
Regal Amplifier Mfg. Corp., 14-16 W. 17th St., New York, N. Y.	●	●	●		●																	
Remler Co. Ltd., 2101 Bryant St., San Francisco, Cal.	●	●	●		●				●		●											
Rola Co., 2530-2570 East Superior Ave., Cleveland, Ohio						●	●	●														
Selectar Mfg. Corp., 80 West 15th St., New York, N. Y. (Formerly "Bruno Labs.")																●	●					
Setchell-Carlson, Inc., 2233 University Ave., St. Paul, Minn.	●	●	●		●					●		●	●	●			●	●				
Shure Bros. Co., Inc., 225 W. Huron St., Chicago, Ill.									●													
Simpson, Mark, Mfg. Co., 186 West 4th St., ("Masco") New York, N.Y.	●	●	●							●		●	●	●			●	●				
Sound App. Co., 150 W. 46th St., New York, N. Y.	●		●																			
Sound Products, 704 N. Curson Ave., Hollywood, Cal.	●	●	●																			
Sound Systems, Inc., 42 W. 15th St., New York, N. Y.	●	●	●		●				●													
Standard Transf. Corp., 1500 N. Halstead St., Chicago, Ill. (*Amplifiers only*)	●																					
Stromberg-Carlson Tel. Mfg. Co., 100 Carlson Rd., Rochester, N. Y.	●				●	●	●	●	●	●								●		●		
Sundt Eng. Co., 4757 Ravenswood Ave., Chicago, Ill. (*P. A. equipt. for Musical Towers, Carillons*)	●		●																			
Talk-A-Phone Mfg. Co., 1219 W. Van Buren St., Chicago, Ill.					●																	
Terpening, L. H., 224 E. 23rd St., New York, N. Y.		●																				
Thordarson Electric Mfg. Co., 500 W. Huron St., Chicago, Ill. (*Amplifiers only*)	●		●																			
Toledo Sound Equip. Labs., 1215 Jackson Ave., Toledo, Ohio	●		●						●													
Transfone Corp., 14 W. 45th St., New York, N. Y. (*No longer mnf'g*)																						
Transformer Corp. of America, 69 Wooster St., New York, N. Y.	●	●	●		●																	
Triumph Mfg. Co., 4017 W. Lake St., Chicago, Ill.					●																	
Turner, The, Co., Cedar Rapids, Iowa										●		●	●	●								
Unit Reproducers Mfg. Co., 999 E. Main St., Rochester, N. Y.									●											●		
United Reproducers, Springfield, Ohio						●	●	●														
United Sound Eng. Co., 2233 University Ave., St. Paul, Minn.	●	●	●		●				●											●		
United Sound Products, 816 W. North Ave., Chicago, Ill. (*Wireless type*)					●																	
United Teletone Corp., 2 Selleck St., Stamford, Conn.						●		●	●													
United Transformer Corp., 150 Varick St., New York, N. Y. (*Amplifiers only*)	●																					
Universal Microphone Co., 424 Warren Lane, Inglewood, Cal.		●	●							●	●	●		●		●	●					
University Labs., 225 Varick St., New York, N. Y.								●	●													
Upco Eng. Labs., Inc., 254 Canal St., New York, N. Y.																				●		
Utah Radio Products Co., 812 Orleans St., Chicago, Ill.						●		●	●													
Vibraloc Mfg. Co., 1273 Mission St., San Francisco, Cal.	●		●																			
Victor Animatograph Corp., Davenport, Iowa				●																		
Volum Tone Co., 226 N. Main, Los Angeles, Cal.	●																					
Webster-Rauland, 4245 Knox Ave., Chicago, Ill.	●	●	●		●	●		●	●							●				●		
Webster Elect. Co., Racine, Wisc.	●	●	●		●				●				●			●				●		
Western Elect. Co., 195 Broadway, New York, N. Y.	●				●	●			●	●				●			●	●	●	●		
Wholesale Radio Service Co., Inc. (see Lafayette Radio Corp.)																						
Wright Inc., 2233 University Ave., St. Paul, Minn.						●		●														
Wright-De Coster Inc., St. Paul, Minn.						●		●	●													
Zenith Radio Corp., 6001 Dickens Ave., Chicago, Ill. (*Wireless type*)					●																	

*NOTE: For "Power Supply Eq'pt." and "Battery Chargers" see the directory of ACCESSORIES MNFR'S.

†NOTE: For Loudspeaker "Cones," "Field Coils" & "Assories" see the directory of PARTS MNFR'S.

‡NOTE: For "Phono Motors," "Record Changers," "Needles," "Blanks," etc., see the directory of ACCESSORIES MNFR'S

MANUFACTURER	Adapters	Analyzers—(Condenser)	Analyzers—(Radio Receiver)	Bridges—(Condenser)	Bridges—(Inductance)	Frequency Modulators	Multimeters	Oscillators A-F	Oscillators I-F	Oscillators R-F	Loudspeaker Testers	Oscillographs	Output Meters	Tube Checkers	Vibrator Testers	V.T. Voltmeters	Interference Locators	Plugs*; Switches†	Miscellaneous
Aerovox Corp., New Bedford, Mass.		●		●	●												●		
Alden Products Co., 715 Center St., Brockton, Mass.	●																		
American Phenolic Corp., 1250 W. Van Buren St., Chicago, Ill.	●																		
Apparatus Design Co., Elizabeth & Randolph Sts., Chicago, Ill.														●					
Ballatine Labs., Inc., Boonton, N. J.																●			
Bendix Products Corp., 401 Bendix Drive, South Bend, Ind.			●								●				●				
Bud Radio, Inc., 5205 Cedar Ave., Cleveland, Ohio	●																		
Burton-Rogers Co., 857 Boylston Ave., Boston, Mass.	●		●				●		●	●		●	●		●				
Carron Mfg. Co., 415 S. Aberdeen St., Chicago, Ill.								●			●								
Clough Brengle Co., 5501 Broadway, Chicago, Ill.		●	●	●	●	●	●	●	●	●		●	●	●		●			
Consolidated Wire and Assoc. Corps., 1635 S. Clinton St., Chicago, Ill.		●									●		●	●					
Cornell-Dubilier Elect. Corp., 1003 Hamilton Blvd., South Plainfield, N.J.		●		●															
Dayco Radio Corp., 915 Valley St., Dayton, Ohio			●			•	●					●		●	●				
Dayton Acme Co., 2339 Gilbert Ave., Cincinnati, Ohio			●											●					
DeJur-Amsco Corp., Shelton, Conn.							●												
Deutschmann, Tobe, Corp., Canton, Mass.		●		●	●												●		
Du Mont, Allen B., Labs., Inc., 2 Main Ave., Passaic, N. J.						●						●							
Ferris Inst. Corp., Boonton Ave., Boonton, N. J.									●	●									
Foraco Corp., 2111 Woodward Ave., Detroit, Mich.														●					
General Radio Co., 30 State St., Cambridge, Mass.				●	●			●	●	●			●			●			
Gray Inst. Co., 66 W. Jackson St., Philadelphia, Pa.							●							●					
Hewlett-Packard Co., 481 Page Mill Road, Palo Alto, Cal.								●											
Hickock Elec. Inst. Co., 10308 Dupont Ave., Cleveland, Ohio		●	●	●	●	●	●	●	●	●		●	●	●	●	●			
Insuline Corp. of America, 30-30 Northern Blvd., Long Island City, N.Y.	●																		
Jackson Elec. Inst. Co., 128 Wayne Ave., Dayton, Ohio		●	●	●		●	●	●	●	●		●		●					
J. M. P. Mfg. Co., Inc., 3049 N. 34th St., Milwaukee, Wisc.							●					●		●					
Mallory, P. R., & Co., Inc., Indianapolis, Ind.															●				
Meissner Mfg. Co., Mt. Carmel, Ill.			●																
Million Radio & Telev., 1617 North Damen Ave., Chicago, Ill.			●				●		●	●	●				●				
Monarch Mfg. Co., 3341 Belmont Ave., Chicago, Ill.				●	●					●			●	●		●			
Multiplex Radio Service, 88A Fourth Ave., Brooklyn, N. Y.											●								
Nagle, Ted, Equip. Corp., General Motors Bldg., Detroit, Mich.								•				●							
National Co., 61 Sherman St., Malden, Mass.												●							
Ohio Inst. Co., 9410 St. Catherine Ave., Cleveland, Ohio			●				●												
Philco Radio & Telev. Corp., Tioga & C Sts., Philadelphia, Pa.			●				●	●	●	●			●	●					
Precision App. Corp., 92 Horace Harding Blv'd., Elmhurst, N. Y.			●				●		●	●			●	●					
Radiart Corp., W. 62nd St. & Barberton Ave., Cleveland, Ohio															●				
Radio City Products Co., 127-133 West 26th St., New York, N. Y.	●		●				●		●	●			●	●					
Radio Products Co., (*"Dayrad" division now acquired by Dayco Radio Corp.*)																			
Radiotechnic Labs., Inc., 1328 Sherman Ave., Evanston, Ill.			●											●					

*NOTE: For manufacturers of "Plugs" see the directory of PARTS MNFR'S.

†NOTE: For manufacturers of "Switches" see the directory of PARTS MNFR'S.

*See Note at bottom of page 709

—(Continued)

TEST EQP'T. MNF'RS.—(Cont'd)

MANUFACTURER	Adapters	Analyzers—(Condenser)	Analyzers—(Radio Receiver)	Bridges—(Condenser)	Bridges—(Inductance)	Frequency Modulators	Multimeters	Oscillators: A-F	Oscillators: I-F	Oscillators: R-F	Loudspeaker Testers	Oscillographs	Output Meters	Tube Checkers	Vibrator Testers	V.T. Voltmeters	Interference Locators	Plugs*; Switches†							Miscellaneous
Radio Corp. of America, RCA Victor Division, Camden, N. J.	●	●	●	●	●	●	●	●	●	●		●	●	●		●									
Readrite Meter Works, Bluffton, Ohio	●	●	●	●	●	●	●	●	●	●		●	●	●		●									
Shallcross Mfg. Co., 10 Jackson Ave., Collingdale, Pa.					●		●		●	●				●											
Simpson Elec. Co., 5216 Kinzie St., Chicago, Ill.			●	●			●		●	●				●											
Solar Mfg. Corp., 586 Ave. A., Bayonne, N. J.		●		●																					
Sprague Prod. Co., North Adams, Mass.				●													●								
Sterling Mfg. Co., 9205 Detroit Ave., Cleveland, Ohio							●																		
Sundt Engineering Co., 4757 Ravenswood Ave., Chicago, Ill.												●													
Supreme Instruments Corp., Greenwood, Miss.		●	●	●	●	●	●	●	●	●		●	●	●											
Tefft Radio Co., Plymouth, Mich.		●	●				●	●	●	●															
Televiso Products Inc., 2400 N. Sheffield Blvd., Chicago, Ill.																●									
Thordarson Elect. Mfg. Co., 500 W. Huron St., Chicago, Ill.												●													
Triplett Elec. Inst. Co., Bluffton, Ohio		●	●	●			●		●	●		●	●	●	●	●									
Triumph Mfg. Co., 4017 W. Lake St., Chicago, Ill.						●	●	●	●	●		●	●	●		●									
United Motors Service, Detroit, Mich. (*No longer mf'g.*)																									
Webber, Earl, Co., 4352 West Roosevelt Road, Chicago, Ill.		●	●				●		●	●						●									
Westinghouse Electric & Mfg. Co., Newark, N. J.							●									●									
Weston Elec. Inst. Corp., Frelinghuysen Ave., Newark, N. J.		●	●				●		●	●						●									

*NOTE: For manufacturers of "Plugs" see the directory of PARTS MNFR'S.

†NOTE: For manufacturers of "Switches" see the directory of PARTS MNFR'S.

DIRECTORY OF "CORRESPONDENCE", and "RESIDENT" RADIO SCHOOLS

AMERICAN RADIO INST., 1123 Broadway, New York, N. Y.
AMERICAN SCHOOL, Drexel Ave. at 58 St., Chicago, Ill.
AMER. SCHOOL OF AIRCRAFT INSTRUMENTS, 3903 San Fernando Road, Glendale, Cal.
AMERICAN TELEV. LABORATORIES, 433 East Erie St., Chicago, Ill.
CAPITOL RADIO ENGINEERING INST., 3224 16 St., N.W., Wash., D. C.
COMMERCIAL RADIO INSTITUTE, 38 W. Biddle St., Baltimore, Md.
COYNE ELECTRICAL SCHOOL, 500 S. Paulina St., Chicago, Ill.
DODGE'S TELEGRAPH & RADIO INST., Turner St., Valparaiso, Indiana
EASTERN RADIO INST., 899 Boylston St., Boston, Mass.
GULF RADIO SCHOOL, 315 St. Charles St., New Orleans, La.
INTERNATIONAL CORRESPONDENCE SCHOOLS, Scranton, Penna.
LINCOLN ENGINEERING SCHOOL, Lincoln, Nebraska
MASSACHUSETTS RADIO SCHOOL, 18 Boylston St., Boston, Mass.
MIDLAND RADIO & TELEV. SCHOOLS, INC., Power & Light Bldg., Kansas City, Mo.
MELVILLE AERONAUTICAL RADIO SCHOOL, 45 W. 45 St., New York, N. Y.
METROPOLITAN TECHNICAL SCHOOL, 7 Central Park West, New York, N. Y.
NATIONAL RADIO INSTITUTE, Washington, D. C.
NATIONAL SCHOOLS, Figueroa St., Los Angeles, California.
NEW YORK TECHNICAL INSTITUTE, 108 Fifth Ave., New York, N. Y.
NEW YORK, Y.M.C.A. SCHOOLS, 7 W. 63 St., New York, N. Y., 1119 Bedford Ave., Brooklyn, N. Y.
NILSON RADIO SCHOOL, 51 E. 42 St., New York, N. Y.
PACIFIC RADIO SCHOOL, 735 Larkin St., San Francisco, California.
PHILADELPHIA SCHOOL OF WIRELESS TELEGRAPHY, 1533 Pine St., Philadelphia, Pa.
PORT ARTHUR COLLEGE, Port Arthur, Texas.
RADIO-TELEVISION INSTITUTE, INC., 480 Lexington Ave., New York, N. Y.
RADIO TRAINING ASSOCIATION OF AMER., 1559 Devon Ave., Chicago, Ill.
RCA INSTITUTES, Inc., 75 Varick St., New York, N. Y., and 1154 Merchandise Mart., Chicago, Ill.
SPRAYBERRY ACADEMY OF RADIO, Box 500 WB, Pueblo, Colorado.
UNITED RADIO-TELEV. INST., Inc., 106 Halsey St., Newark, N. J.
UNIVERSAL TELEVISION SYSTEM, INC., Candler Building, Kansas City, Mo.
YMCA SCHOOLS (New York), 6 W. 64 St., New York, N. Y., 1119 Bedford Ave., Brooklyn, N. Y.

DIRECTORY OF RADIO MANUAL, HANDBOOK, and TEXTBOOK PUBLISHERS

(as indicated)

AMERICAN RADIO RELAY LEAGUE, W. Hartford, Conn. (*Handbooks*)
AMERICAN TECHNICAL SOCIETY, Drexel at 58 St., Chicago, Ill. (*Textbooks*)
AUDEL PUBLISHERS, 49 W. 23 St., New York, N. Y. (*Textbooks*)
CAMERON PUBLISHING CO., Coral Gables, Florida. (*Textbooks*)
DRAKE & CO., FRED J., 79 N. Michigan Ave., Chicago, Ill. (*Textbooks*)
EDITORS & ENGINEERS LT'D., 1300 Kenwood Road, Santa Barbara, Calif. (*Handbooks*)
MACMILLAN COMPANY, THE, 60 Fifth Ave., New York, N. Y. (*Textbooks*)
MALLORY & CO., P. R., Indianapolis, Ind. (*Handbooks*)
McGRAW HILL PUBLISHING CO., 330 W. 42 St., New York, N. Y. (*Textbooks*)
POPULAR BOOK CORP., 25 West Broadway, New York, N. Y. (*Manuals, Handbooks, Textbooks*)
PRENTICE-HALL INC., 70 Fifth Ave., N. Y. C. (*Textbooks*)
RADCRAFT PUBLICATIONS, Inc., 25 West Broadway, New York, N. Y. (*Textbooks*)
RADIO & TECHNICAL DIVISION, MURRAY HILL BOOKS, INC., 232 Madison Avenue, New York 16, N. Y. (*Handbooks, Textbooks*)
RADIOLAB PUBLISHING CO., 652 Montgomery St., Brooklyn, New York, (*Radio Laboratory Job Sheet Manual*)
RIDER, JOHN F., PUBLISHER, INC., 404 Fourth Ave., New York, N. Y. (*Manuals, Textbooks*)
RONALD PRESS CO., 15 E. 26 St., New York, N. Y. (*Textbooks*)
SHERWOOD PRESS, Box 552, Edgewater Beach, Cleveland, Ohio (*Textbooks*)
VAN NOSTRAND CO., INC., D., 250 Fourth Ave., New York, N. Y. (*Textbooks*)
WILEY & SONS, INC., JOHN, 440 Fourth Ave., New York, N. Y. (*Textbooks*)

DIRECTORY OF RADIO MAGAZINES, and TRADE PUBLICATIONS

COMMUNICATIONS, 19 E. 47 St., New York, N. Y.
ELECTRONICS, 330 W. 42 St., New York, N. Y.
ELECTRONIC INDUSTRIES, 480 Lexington Ave., N. Y. C.
FM, 21 E. 37 St., New York, N. Y.
QST MAGAZINE, West Hartford, Conn.
"RADIO", RADIO MAGAZINES INC., 132 W. 43 St., New York, N. Y.
RADIO CRAFT, 25 West Broadway, New York, N. Y.
RADIO-ELECTRONIC PARTS JOURNAL, 1270 Sixth Ave., N. Y. C.
RADIO JOBBER NEWS, 524 E. Superior Ave., Cleveland, Ohio
RADIO NEWS, 540 N. Michigan Ave., Chicago, Ill.
RADIO SERVICE DEALER, 132 W. 43 St., New York, N. Y.
RADIO-TELEV. JOURNAL & TALKING MACHINE WORLD, 1270 Sixth Ave., New York, N. Y.
RADIO RETAILING—TODAY, 480 Lexington Ave., New York, N. Y.
SERVICE, 19 E. 47 St., New York, N. Y.

— INDEX —

(The Numerals Refer to Page Numbers)

— A —

"A" batteries ..... (see *Batteries*)
"A-B" batteries ..... (see *Batteries*)
Accessories, radio, mnfr's. of 720
A.C. plate resistance of tube 708
Actual troubles in receivers 1
Addresses of radio receiver, parts, accessories, etc. mnfrs. 709-737
Air-core coil design 674-675, 707
Aligning superhets 408, 411, 415
Alignment peaks (i-f) 415-477
Alloys, melting points of 650-651
Alloys, resistance data for 650-651
Alloys, specific resistance of 650-651
Alternating current circuit formulae 705, 706
Alternating current sine-wave relations 706
American-Canadian receiver cross-index 480
American wire gauge 670, 672
Amplification factor (formula) 708
Amplifier gain 708
Amplifiers, resistance-coupled, data & design 681-685
Amplifier tube formulae 708
Antenna data, auto-radio for cars 505-513
Area units, conversion factors for 701
Army preferred tube types for new eq'pt. 623
Army standard tube types & their commercial equivalents 623
Audio transformer (RMA Color Code for leads) 640
Automatic record changers, "Case Histories" of 1
Automobile:
- breaker point gaps (correct) 505-513
- electrical system wiring diagrams 529-541
- generator, max. normal charging rates 505-513
- polarity of storage battery grounded terminal 505-513
- spark-plug gaps (correct) 505-513

Auto radio:
- antenna location and lead-in data for cars 505-513
- battery charging rates 505-513
- by-pass condenser data 505-528
- "Case Histories' ..... 1 to 404, 514 to 528
- dial directions of tuning controls 499
- gear-ratios and dial directions of tuning controls 499
- "grounding" data 505-528
- ignition interference remedies 505-528
- installation and car ignition system data chart 505-513
- suppressor data 505-528
- trouble-shooting charts 488, 514
- tuning controls, gear ratios and dial directions 499-504

Average current in a.c. circuit 706
Average voltage in a.c. circuit 706

— B —

Ballast resistor data and designation code 577-582
Bantam tube bases and sockets 589, 593
B (*international*) 701
Base-pin diagrams of tubes 590, 609-611
Base pin, numbering and designation system for tubes (RMA) 590-593
Batteries:
- cable lead color code (RMA) 644
- (car) charging rates for 505-513
- (car), polarity of grounded terminal of 505-513
- data charts for 549-562
- electrically comparable 556
- electrical specifications of 557-562
- grounded terminal (car batt.) 505-513
- physical dimensions of 557-562
- replacement chart (portable receiver batteries) 549-556

— B — (Cont'd)

- standard-package quantities 557-562
- standard-package weights 557-562
- terminal arrangements on 557-562

"B" batteries ..... (see *Batteries*)
"B"-filter design data 680
Bias resistor (calculation of value needed) 564
Bias resistor chart 563-576
Bias voltage (cut-off value) 565
Birmingham (or *Stubs'*) iron wire gauge 671
Blocking condensers 682
"Bonding" for auto-radio noise elimination 505-528
Breaker-point gaps (car), correct 505-513
British standard wire gauge 671
B & S wire gauge 670, 672
Buffer condenser (vibrator) replacements, chart 542-548
Built-in antenna data (auto radio) 505-513
Bulbs, dial lamp 630-632
By-pass condenser installation for auto radios 505-528

— C —

Cable, battery lead, color code (RMA) 644
Calculations, use of exponents in 703
Canadian-American receiver cross-index 480
Capacitance of a condenser (formula) 705
Capacitive reactance 658, 705
Car batteries, polarity of grounded terminal 505-513
Car wiring diagrams 529-541
"Case Histories" of "home" and "auto-radio" receivers and automatic record changers ..... 1 to 404, 514 to 528
Cathode ray tube characteristics & basing 619
Centigrade scale, conversion to Fahrenheit 701
Characteristics:
- cathode ray tubes 619
- receiving tubes 594-611
- special-purpose tubes 616
- transmitting tubes 618

Charging rates (automobile generators) 505-513
Charts:
- auto-radio trouble-shooting 488
- ballast resistor 577-582
- batteries (electrically comparable) 556
- batteries (replacement) 549-556
- battery dimensions 557-562
- battery specifications 557-562
- cathode ray tubes 619
- coil design (single-layer) 674-675, 707
- condenser (buffer) replacement 542-548
- condenser color code 638, 639
- condenser, replacement 542, 646
- dial lamps 630, 632
- drill and tap sizes 696-698
- filter design 680
- grid bias resistor 563-576
- home-radio trouble-shooting ..... 1 ,481
- "Litz" wire 668, 669
- Magnet wire 672-673
- Ohm's law 647, 704
- parallel resistance—series capacitance calculation 652
- pilot lamp data 630-632
- plug-in resistor 577-582
- "preferred tube types" for army-navy eqp't. 623
- "preferred value" resistors 636
- reactance 654-657, 705
- reactance and resistance in series—or parallel 658, 705
- resistance-coupled a-f amplifier 681-685
- resistance-coupled phase inverters 681-685
- resistor color code (RMA) 633-635

— C — (Cont'd)

resistor-cord color code (RMA) 633-635
resistor design and power rating 648-649
special-purpose tubes 616-617
substitution tubes for receivers 612-615
"time constants" 662-664
tone control arrangements 665-667
transformer design 676-679
transmitting tubes 618
trouble-shooting for receiver troubles 1-404, 514-528
tube base terminal arrangements 590-611, 617, 618, 619
tube clasisfication 583-586
tube socket terminal arrangements 590-611, 617, 618, 619
volume control arrangements 665-667
Circuit diagrams of car electrical systems 529-541
Classification chart for tubes 583-586
Clearance drill sizes 698
Codes (color) ..... (see RMA color codes)
Coil design chart (and formulae) 674, 675, 707
Coil factor of merit 706
Coil, form factor of 707
Color code (*Philco*) 635
Color codes (*RMA*) ..... (see RMA color codes)
Commercial equivalents of Army tubes 623
Commercial equivalents of Navy tubes 622
Comparable batteries 556
Condenser (buffer) replacement chart 542-548
Condenser, capacitance of (formula) 705
Condenser capacity tolerance 638-639
Condenser (molded) color code (RMA) 638-639
Condenser factor of merit 706
Condenser formulae (series and parallel) 705
Condenser, mica, color code (RMA) 638-639
Condenser, power factor of 706
Condenser reactance 654-657, 705
Condenser replacement chart 646
Condensers (blocking and coupling) 681-685
Condensers in series 652, 705
Condensers, voltage rating color code 638-639
Constants, vacuum tube 708
Conversion factors for electrical, physical, and mathematical units 700-701
Conversion of frequency to wavelength 693-695
Conversion of metric prefix units 702
Conversion of wavelength to frequency 693-695
Copper wire table (bare and insulated) 672-673
"Correspondence" radio schools 738
"Coupling" condensers 682
Cross-Index, American, RCA and RCA-Victor, G. E. Whs'e., and Graybar receiver model numbers 478
Cross-Index, Canadian RCA, G.E., Whs'e., and American RCA and RCA-Victor receivers 480
Current-carrying capacities of wires 672-673
Current ratios 690-692
Cut-off bias voltage 565

— D —

Decibel 690-692, 708
Decibel conversion tables 690-692
Decimal and metric equivalents of common fractions 699
Design charts:
filters 680
power transformer 678
resistance-coupled amplifiers and phase inverters 681-685
resistor 648
single-layer coil 674-675, 707
transformer 678
Diagrams, elect. wiring of cars 529-541
Diagrams, schematic, RMA symbols for 645
Dial directions and gear-ratios of auto-radio tuning controls 499
Dial lamp data chart and RMA color code 630-632
Dimensions of dry batteries 557-562
Directory:
of intercommunicator manufacturers 733
of radio accessory manufacturers 720
of radio parts manufacturers 728
of sound amplifier equipment manufacturers 733
of test equipment manufacturers 736

— D — (Cont'd)

Dissipation constant of coils or condensers .....
Drill and tap sizes 69
Drilling speeds and data 69
Dry Batteries ..... (see *Batte*
Dynamic speaker lead color code .....
Dynamic speaker plug connections .....

— E —

Effective values of current and voltage .....
Electrical formulae, summary of 70
Electrical specifications of A, B, and A-B batteries 55
Electrical units, conversion factors for 700
Electrical wiring diagrams of automobiles 52
Electrically comparable A, B and A-B batteries .....
Energy units, conversion factors for .....
English standard wire gauge .....
"Equivalents" (commercial) of Army tubes .....
"Equivalents (commercial) of Navy tubes .....
"Equivalent" commercial receiving tube cross-index 594-608, 612,
Exponents and their use in radio calculations .....

— F —

Facsimile recorder & receiver mnfr's. .....
"Factor of merit" of coils or condensers .....
Fahrenheit scale, conversion to Centigrade .....
Farm-radio dry batteries (physical dimensions & electrical specifications 55
Feedback in i-f amplifiers 40
Filter design chart .....
Filters (low-pass) .....
Fixed-resistor color code (RMA) 63
Flexible-resistor color code (RMA) 633
Force units, conversion factors for .....
Form factor, of coils .....
Formulae used in radio and service work (summary) 704
Fractions, decimal and millimeter equivalents of .....
Frequency, wavelength, and L×C conversion table 693
Frequency, wavelength formulae .....

— G —

Gain of amplifier tube (mu) .....
Gain of amplifier stage (formula) .....
Gap, correct breaker-point 505
correct spark-plug 505
Gauges, wire & sheet metal 670
Gear ratios, (and dial directions) of auto-radio tuning controls .....
Generators, maximum normal charging rates for American cars 505
Grid-bias resistor chart 563
Grid-bias resistor value (calculation of) .....
Grounded terminal of car batteries 505

— H —

Handbook (radio) publishers .....
Home receiver "Case Histories" ..... 1 to
Home receiver trouble-shooting chart .....

— I —

I-F amplifiers:
aligning 408, 411,
anti-resonance oscillation in .....
feedback in .....
oscillation in 408-
I-F peaks of superhet. receivers 408-
I-F peak frequency (how to determine) 415-
I-F transformers:
band-expanding type .....
capacity-coupling in .....
color code of leads .....
design of 408,
double-tuned .....

— I — (Cont'd)

ms of 405
talling replacement units 407
n-core type 406
air procedure 407
lacing 407
ecting correct replacement unit 407
elding leads of 408
gle-tuned 405
ple-tuned 406
tuned 405
ion interference in cars 505-528
ion wiring diagrams for cars 529-541
ination units, conversion factors for 701
dance 705, 706
dance ratio of output transf. (checking) 642
dance relations in resonant circuits 706
rial wire gauge 671
asing ranges of milliammeters and voltmeters 704
ctance chart for coils 674-675
ctance of single-layer coils (formula) 707
ctive reactance 654-658, 705, 706
ctive reactance chart 654-658
ated copper wire table 672-673
communicator systems:
nufacturers of, trade directory 733
ference, ignition, remedies for 505-528
mediate-frequency transf. lead color code (RMA) 408, 641
mediate peak frequencies of superhet receivers 415-477
stage a-f transf. lead color code (RMA) 642

— L —

', resonance wavelength & frequency conversion table 693-695
-in locations in automobiles 505-513
th units, conversion factors for 701
r symbols for vacuum tubes 707-708
t units, conversion factors for 701
wire table 668, 669
-in tube bases 591-592
rithms 686-689
al (Lock-in) tube bases 591-592
speaker lead color code 643
speaker plug connections 643
pass filter design chart 680

— M —

ine screw sizes 698
ine screws, drills and taps for 698
azine (radio) publishers 738
et wire table 672-673
netic units, conversion factors for 700
ual (radio), publishers of 738
ufacturers trade directories (radio industry) 709-737
ematical units, conversion factors for 700-701
imum power output (formula) 708
imum undistorted power output (formula) 708
imum values of current and voltage 706
ing Points of metals and alloys 650-651
ls, melting points of 650-651
ls, resistance data for 650-651
ic equivalents of decimals and common fractions 699
ic prefixes and conversion factors for them 702
, formula for 704
condenser color code (RMA) 638-639
of Standard Cable 690
ammeters, increasing ranges of 704
el number cross-index, American RCA, G. E., Wh'se. etc. receivers 478
el number cross-index, Canadian—American receivers 480
ernizing old receivers 624
ed condenser color code (RMA) 638-639
ed resistor color code (RMA) 633
iple-etched tubes 624
iplier resistors (shunt, and series) 704
ual conductance (formula) 708

— N —

Nagoaka's correction factor 707
Navy prefered tube type for new eqp't. 623
Navy standard tube types & their commercial equivalents 622, 623
Neper 690

— O —

Octal tube bases 591
Ohm's Law (for d.c. circuits) 647, 704, 706
Ohm's Law (for a.c. circuits) 706
Ohm's Law chart 647
Operating characteristics, tubes 594-611, 616, 618, 619
Oscillation in i-f amplifiers 408-410
Output of tubes 708
Output transformer:
color code for leads (RMA) 642
impedance-ratio (checking) 642
turns-ratio (checking) 642

— P —

Parallel condensers, formula for 705
Parallel reactance and resistance (chart) 658
Parallel resistances—series capacitances chart 652
Parallel resistors, formulae for 652, 704
Parallel resonant circuits 706
Parts mnfr's., directory of 728
Peak intermediate frequencies of receivers 415-477
Persistent ignition interference, elimination of 514-528
Phase inverters, design of 681-685
Philco resistor color code 635
Phonograph motor color code 644
Physical dimensions of dry batteries 557-562
Physical units, conversion factors for 700-701
Pilot lamp data chart and RMA color code 630-632
Plate efficiency of tubes 708
Plate impedance (formula) 708
Plug connections for dynamic speaker leads 643
Plug-in & "ballast" resistor data, and RMA code 577-582
Polarity of car batteries 505-513
Portable receiver batteries (physical dimensions and electrical specifications of) 557-562
Portable receiver battery replacement chart 549-556
Portable receiver electrically comparable batteries 556
Power amplification of tubes 708
Power factor 706
Power factor of condensers 706
Power, formula for 704, 706
Power output of tubes (*formulae*) 708
Power rating design chart for resistors 648, 649
Power ratios 690-692
Power sensitivity of tubes 708
Power transformer design 676-677, 678-679
Power transformer design chart 676-677
Power transformer lead color codes (RCA) 640
Power transformer lead color code (RMA) 640
Power units, conversion factors for 700
Preferred tube types (Army-Navy) for new eqp't. 623
"Preferred value" resistor chart 636
Prefixes, metric 702
Public-address systems and eqp't., mnfr's. of 733
Publishers, radio (handbooks, magazines, manuals, text books) 738

Quantities of dry batteries in standard-package units 557-562

— R —

Radio formulae (summary of) 704-708
Radio schools, directory of 738
Radio trade directories 709-738
Radio tube characteristics charts 594-621
Ratios (current voltage, power) 690-692
RCA power transformer lead color codes 640
Reactance 654-661, 705, 706
Reactance formulae 705, 706

— R — (Cont'd)

Reactance and resistance in series—or parallel 658-661
Reactance chart (of inductances and condensers) 654-657
Reactance of condensers 654-657, 705
Reactance of inductors 654-657, 705
Receiving tube ratings (interpretation of) 628
Receiver "Case Histories" ..... 1 to 404, 514-528
Receiver i-f compilation 415-477
Receiver manufacturers 710-719
Receiver modernization 624
Receiver, trouble-shooting charts 481, 488
Receiver trouble symptoms and remedies 1
Receiver tubes (characteristics & basing) 594-611
Receiver tubes (substitution types) 612-615
Record changers, "Case Histories" of 1
Rectifier tube characteristics 594-611, 616-617
"Relative resistance" values of metals & alloys 650-651
Remedies for auto-radio ignition interference 505-528
Remote control heads for auto radios 499-504
Repair of i-f transformers 405-410
Replacement data charts:
  batteries (dimensions and elect. specifications) 557-562
  batteries (replacement in portable receivers) 549-562
  condensers 646
  condensers in vibrators 542-548
  portable receiver batteries 549-562
  tubes 612-615
  vibrator buffer condensers 542-548
Replacement tubes 594-611, 612-615
Replacement tubes (or replacing "non-standard," or "obsolete" types) 612-615
Replacing i-f transformers 407
"Resident" radio schools 738
Resistance and reactance in series—or parallel 658
Resistance-coupled amplifier design & data 681-685
Resistance-coupled phase inverters 681-685
Resistance:
  alloys, data on 650-651
  data for metals and resistance alloys 650-651
  formulae 650, 651, 704
  graphs for resistors 647-649
  "relative" 650-651, 704
  specific, of metals and resist. alloys 650-651
  temperature coefficient of, ... 650-651, 704
Resistance, effect of temperature upon 650-651, 704
Resistance "tapers" 665-667
Resistor:
  alloys, data on 650-651
  ballast 577-582
  color code (RMA) 633-635
  color code (Philco) 635
  cord color code (RMA) 634, 635
  design chart 648-649
  flexible, color code (RMA) 633-635
  grid-bias chart 563-576
  molded, color code (RMA) 633-635
  plug-in ballast 577-582
  power rating, graphs for 648-649
  resistance, graphs for 647, 648-649
Resistor, multiplier 704
Resistor "preferred value" chart 636
Resistor tolerances 636
Resistors in parallel 652, 704
Resistors in series 704
Resonance chart 675
Resonance circuits, impedance relations in 706
Resonance formulas 693, 706
Resonance, wavelength-frequency-L×C conversion table 693-695
RMA battery cable lead color code 644
RMA color codes 408, 631, 632, 633-644
RMA condenser (molded mica) color code 638-639
RMA dynamic spk'r. lead color code & plug connections 643
RMA molded mica condenser color code 638-639
RMA phono motor color code 644
RMA plug-in resistor designation code 577-582
RMA "preferred value" resistor chart 636
RMA receiving tube ratings (interpretation of) 628
RMA speaker lead color code and plug connections 643

— R — (Cont'd)

RMA symbols for radio schematic diagrams 4
RMA symbols (proposed) for schematic wiring diagram
RMA transformer color codes 408, 6
RMA tube base-pin designation & numbering system 5
RMA tube type-number designation system 5

— S —

Schools (radio) directory of 7
Screw sizes 6
Series capacitances, chart for 6
Series capacitances, formulae for 6
Series reactance and resistance chart 6
Series resistors, formula for 6
Series resonant circuits 6
Servicing auto radios 488, 5
Servicing formulae 7
Servicing home radios 1-40
Set manufacturers, directory of 7
"Similar" tube types 594-611, 6
Sine-wave current and voltage relations 6
Single-layer coil design chart (and formulae) 674-67
Skin effect 6
Socket, tube terminal arrangements (RMA) 5
Sound amplifiers, and eqp't mnfr's., directory of 7
Sound recorders, manufacturers of 7
Spark-plug gaps (correct) 5
Speaker lead color code and plug connections 6
Special-purpose tubes (characteristics) 6
Specific resistance of metals and resist. alloys 6
Standard package "quantities" of dry batteries 5
Standard package "weights" of dry batteries 5
Standard RMA color codes ..... (see RMA color c
Standard tube bases 5
Storage battery, "grounded" terminal in cars 5
Stubborn ignition system interference remedies 5
Stubbs' iron and steel wire gauge 6
Substitution tube types for receivers 6
Superheterodyne receiver aligning 4
Superheterodyne receiver intermediate peak frequencies 4
Suppressors, ignition system, installation of 5
Symbols, letter, for vacuum tubes 7
Symbols (RMA proposed) for schematic wiring diagram
Symptoms and remedies for receiver troubles 1-404, 481-498, 5

— T —

Table:
  bare and magnet wire 6
  decibel 6
  "Litz" wire 6
  logarithms 6
  wavelength-frequency-L×C (at resonance) 6
"Tapers" (correct for volume or tone controls) 6
Taps and drills (sizes and data) 6
Television receiver manufacturers 7
Temperature coefficients of resistance 650-651
Temperature scales, conversion of 6
Terminal arrangements, of tube bases and sockets 590, 6
Terminal "grounded", of car batteries 5
Terminal arrangements on dry batteries 5
Test eqp't mnfr's. 7
Testers, tube 7
Textbook (radio) publishers 7
"Time constant" charts 6
Tolerance, of condenser capacity 6
Tolerance, resistor 6
Tone control chart 6
Trade directories of radio industry manufacturers 7
Trade names of radio receivers 7
Trade publications (radio) publishers 7
Transformer:
  audio, RMA color code for leads 4
  i-f, RMA color code for leads 408

— T — (Cont'd)

ower, RCA color code for leads 640, 641
ower, RMA color code for leads 640
esign data and chart 676-677, 678-679
ansformers, i-f 405-414, 641
ansmitting tubes, operating characteristics of 618
uble-shooting chart for "home-radio" receiver troubles 481
uble-shooting chart for auto-radio receiver troubles 438
ubles and remedies (receivers) 1-404, 481, 488
ubles, trouble-shooting charts for 481, 488
pe:
mplification factor (formula) 708
ase-pin designation and numbering systems (RMA) 590-593
ase connection charts 590, 609-611
ases, types of 590-593
haracteristics charts 594-621
assification chart 583-586
onstants 708
ormulae 707, 708
dex of types 595-618
perating characteristics 594, 616, 618, 619
utput (formulae) 708
tings (RMA), interpretation of 628
eplacement types 594-611, 612-615
cket connection charts 590, 609-611
sters 626
pe-number designation system, RMA and non-RMA 587-589
es:
rmy types 623
thode-ray (characteristics) 619
ombination) in resist.-coupled amplifiers 681-685
tter symbols for 707, 708
ultiple-etched types 624
avy types 622, 623
referred types" for new Army-Navy eqp't. 623
ecial-purpose (characteristics) 616-617
bstitution types for receivers 612-615
ansmitting 618
pes for replacement of "non-standard", or "obsolete" types 612
d circuits ..... (see *Resonance*)
ng coil design chart 674-675
ng Controls, auto-radio gear-ratios and dial directions of 499-504
s-per-volt chart (transformer design) 676-677

— T — (Cont'd)

Turns-ratio of output transf. (checking the) 642
Twist drill sizes, and drilling data 696
Type number designation systems for
ballast resistors 577-582
tubes (receiving) 587-589

— U —

Units (electrical, physical, mathematical), conversion factors for 700, 701
U. S. Army tube types and their commercial equivalents 623
U. S. Navy tube types and their commercial equivalents 622
U. S. Standard sheet and plate metal gauge 671

— V —

Vacuum tube ..... (see Tube, Tubes)
Vacuum tube formulae 708
Vacuum tube letter symbols 707, 708
Vacuum tubes ..... (see Tube, Tubes)
Vibrator buffer condenser replacements, chart 542-548
Voltage amplification formula 708
Voltage rating color code (condenser) 636-637
Voltage ratios 690-692
Voltage relations (for sine-wave) 706
Voltmeter, increasing range of 704
Voltmeter, multiplier resistor for 704
Volume control chart 665-667

— W —

Washburn & Moen's steel and iron wire gauge 671
Wattage rating chart for resistors 648-649
Wattage ratings of grid-bias resistors 563-576
Watts 649, 700, 704, 706
Wavelength-frequency-L×C (resonance), conversion table 693-695
Wavelength-frequency, formulae for 693, 706
Weights of standard-package quantities of dry batteries 557-562
Wire, current- carrying capacity of 672-673
Wire gauges 670-672
Wire table, (bare and magnet) 672, 673
"litz" wire 668, 669
Wiring diagrams for electrical systems of cars 529-541
Wiring diagrams, proposed RMA symbols for 645